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**SENT VIA ELECTRONIC MAIL**

May 15, 2020

Ms. Lynne Jennings and Ms. Melanie Morash  
U. S. Environmental Protection Agency (USEPA), Region 1  
5 Post Office Square, Suite 100,  
Mail Stop OSRR07-4, Boston, MA 02109-3912

**RE: Documentation of Preliminary Remediation Goals (PRGs) for Soil, Sediment and Surface Water  
Olin Chemical Superfund Site – Wilmington, MA**

Dear Ms. Jennings and Ms. Morash:

The attached technical memorandum summarizes certain Preliminary Remediation Goals (PRGs) and documents the basis for these PRGs for soils, sediments, and surface water at the Olin Chemical Superfund Site (OCSS). The PRGs were developed collaboratively between USEPA and the Olin risk assessors (Rick Sugatt and Mike Murphy, respectively). The transmittal also documents the list of assumptions that were discussed and mutually agreed between USEPA and Olin during a meeting on December 5, 2019.

This memorandum was previously submitted to the USEPA on March 13, 2020 and has been revised to reflect USEPA comments transmitted via email on April 24, 2020.

Please let us know if you have any questions.

Sincerely,  
**OLIN CORPORATION**

A handwritten signature in black ink, appearing to read "J. Cashwell".

James M. Cashwell  
Director, Environmental Remediation

Enclosure

cc: Chinny Esakkiperumal (Olin)  
Libby Bowen (Wood)

# Technical Memorandum

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**To:** Chinny Esakkiperumal  
**From:** Michael Murphy  
**cc:** Nelson Walter  
**Date:** May 15, 2020  
**Re:** **Documentation of Preliminary Remediation Goals (PRGs) for Soils, Sediments, and Surface Water at the Olin Chemical Superfund Site**

**Reviewer:** Elizabeth Bowen  
**Wood File No.:** 6107200016

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## 1.0 Introduction, Purpose, and Summary

This technical memorandum has been prepared to document the basis for certain preliminary remediation goals (PRGs) for soils, sediment, and surface water in support of the on-going preparation of the Feasibility Study (FS) for Operable Unit 1 (OU1) and Operable Unit 2 (OU2) and of the Interim Action Feasibility Study (IAFS) for the Olin Chemical Superfund Site (OCSS). This memo also documents the list of assumptions that were discussed and mutually agreed between USEPA and Olin on November 5, 2019. The PRGs were developed collaboratively between USEPA and the Olin risk assessors (R. Sugatt; and M. Murphy, respectively) in consideration of Applicable or Relevant and Appropriate Requirements (ARARs) and both human health and ecological risks identified for these media in the Baseline Human Health Risk Assessment (BHHRA) and the Baseline Ecological Risk Assessment (BERA) that were included as Appendix M and N in the *Final Remedial Investigation Report, Operable Unit 1 & Operable Unit 2, Olin Chemical Superfund Site, Wilmington, Massachusetts* (Amec Environment & Infrastructure, Inc., 2015).

## 2.0 Soil PRGs

The following approach was employed to derive ecological risk-based PRGs for upland soil and wetland soil as discussed below.

- ) From the BERA, assessment endpoint/measurement endpoint combinations with Inference Weight of Medium/High were identified from the table on pages 3-13 and 3-14 of the BERA. These assessment endpoint/measurement endpoints involve food chain model-based evaluation of site receptors.
- ) Based on review of all the food chain model results for all receptors and exposure areas for soil, all chemicals that were associated with Incremental Hazard Quotient values greater than 1 were identified. The Incremental Hazard Index is the difference between the Hazard Quotient associated with the measured concentrations of chemicals in soil from the exposure areas (presumed to be impacted) and the Hazard Quotient associated with measured concentrations of chemicals in soil from the background area investigated in the RI. The chemicals with Hazard Quotient values above 1 for upland soil and wetland soil are listed below and are also shown in **Table 1**.
  - o BEHP - upland soil EA5 – American robin
  - o Chromium -upland soil EA5 – American robin

- Tin – upland soil EA5 – American robin
- BEHP – upland soil EA5 – Short-tailed Shrew
- Chromium – upland soil EA5 – Short-tailed Shrew
- BEHP – upland soil EA4 – American robin
- BEHP – upland soil EA2 – American robin
- BEHP – upland soil EA2 - Short-tailed Shrew
- BEHP – wetland soil Lower South Ditch – Marsh wren (semi-aquatic)
- Chromium – wetland soil Off-Property West Ditch – Marsh wren (semi-aquatic)

) PRGs were calculated for each chemical, receptor, and soil type identified in the bulleted scenarios above as shown in **Table 1**. As shown in the table, the following PRGs were calculated:

- PRG based on the HQ and the Reasonable Maximum Exposure (RME) exposure point concentration (both taken from food chain model tables in the BERA) calculated based on the No-Observed Adverse Effect Level (NOAEL) (Column 11)
  - The general equation for calculating the PRG is:  

$$\text{PRG (mg/kg)} = (\text{exposure point concentration from the BERA divided by the HQ from the BERA})$$
  - The target HQ is 1 for the PRG.
- PRG based on the HQ and the RME exposure point concentration calculated based on the Lowest Observed Adverse Effect Level (LOAEL) (Column 12)
- Geometric mean of the RME PRGs based on the NOAEL and LOAEL (Column 13)
- Among the upland soil scenarios, for each chemical (chromium, BEHP, and tin), a PRG was selected as the upland soil PRG for that chemical to apply to all areas. These PRGs are highlighted in yellow shading in **Table 1**.
- The wetland soil scenarios are those identified for BEHP and the marsh wren at the Lower South Ditch and for chromium and the Marsh wren at the Off-Property West Ditch. The PRGs shown for those single scenarios were selected as PRGs for all wetland soils (also highlighted with yellow shading).
- Note: although tin had a HQ above 1 for food chain scenarios for EA5 soil, the EPC was anomalous and not representative of soils in other exposure areas. A PRG for tin was not selected as the PRGs for chromium and BEHP in soil of EA5 will already require remediation of the soils in that area.
- Note: **Table 1** identifies those BERA tables that are the source of the HQ and EPC values used in calculating the PRGs. The most recent, updated **Table 4.5-3** is attached to this memorandum (included in attachment A). This table replaces the table in the BERA.

**Table 2** summarizes the upland soil and wetland soil PRGs (rounded from **Table 1**) as well as the sediment and surface water PRGs.

### 3.0 Sediment PRGs

The BERA concluded that adverse effects to ecological receptors may be possible for Lower South Ditch sediment due to chromium and BEHP. This conclusion was based on sediment toxicity testing, comparison of sediment concentrations to literature benchmarks, and food chain modeling for insect-eating birds but not for omnivorous birds or mammals. Sediment benchmarks could not be reliably derived from the multi-media food chain modeling nor from the sediment toxicity tests. Therefore, sediment PRGs have been identified from literature sources for chromium and BEHP.

The widely used reference document Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems (MacDonald et. al, 2000) identifies a Probable Effects Concentration (PEC) of 111 mg/kg for chromium in sediment. The European Chemicals Agency (ECHA) dossier for chromium includes information that indicates that approximately 100 mg/kg is an appropriate concentration for a sediment PRG. The dossier can be found at:

<https://echa.europa.eu/registration-dossier/-/registered-dossier/15551>

Given the general agreement between the MacDonald et. al reference and the ECHA dossier, a sediment PRG for chromium is identified as 100 mg/kg.

The European Chemicals Agency (ECHA) dossier for BEHP includes information that indicates that approximately 100 mg/kg is an appropriate concentration for a sediment PRG. The dossier can be found at:

<https://echa-term.echa.europa.eu/ro/web/guest/registration-dossier/-/registered-dossier/15358/6/3>

The recommended sediment PRG for BEHP is 100 mg/kg. The sediment PRGs are also summarized in **Table 2**.

The currently available data set suggests that most of the PRG exceedances occur within the top one foot of sediments. During design, additional data will be collected to verify the depth of excavation needed to achieve the PRGs. Following sediment removal, sampling will be conducted to demonstrate that the remaining sediments achieve the PRGs.

## 4.0 Surface Water PRGs

The BERA concluded that adverse effects to aquatic organisms may be possible for South Ditch surface water, due to chromium and ammonia concentrations (Applicable or Relevant and Appropriate Requirements (ARARs)). Therefore, PRGs were developed for chromium and ammonia in surface water.

PRGs for chromium and ammonia in surface water were identified as site-specific ambient water quality criteria (Criterion Continuous Concentration or CCC) calculated per USEPA guidance. The site-specific chromium CCC of 0.10 mg/L was documented in Table 3.12-3 of the BERA (Included in **Attachment A**). This concentration, for dissolved chromium, was calculated using USEPA equations for deriving hardness-dependent criteria using the arithmetic mean of surface water hardness for the South Ditch (177 mg/L CaCO<sub>3</sub>). The equations are presented in the footnotes of BERA Table 3.12-3.

The site-specific ammonia CCC was calculated based on site-specific surface water temperature and pH data consistent with Table N-1 in Appendix N of *Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater* (USEPA, 2013). The documentation of the site-specific CCC is presented in *Site-Specific AWQC for Ammonia – Olin Chemical Superfund Site* (Wood 2019) submitted by Olin to USEPA by electronic mail on November 26, 2019. This memorandum identified a CCC of 14 mg/L for the East Ditch and 19 mg/L for the South Ditch. USEPA has identified a single site-specific ammonia PRG for surface water at the site of 15 mg/L. The chromium and ammonia PRGs are summarized in **Table 2**.

## 5.0 References

AMEC Environment & Infrastructure, Inc. (AMEC), 2015. *Final Remedial Investigation Report, Operable Unit 1 & Operable Unit 2, Olin Chemical Superfund Site, Wilmington, Massachusetts*, July.

MacDonald, D.D., C.G. Ingersoll, & T.A. Berger, 2000. *Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems*. Archives of Environmental Contamination and Toxicology 39:20-31.

USEPA, 2013. *Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater 2013*, EPA 822-R-18-002, April.

Wood Environment & Infrastructure Solutions, Inc., 2019. *Site-Specific AWQC for Ammonia – Olin Chemical Superfund Site, November 25*.

Please contact James Cashwell or Chinny Esakkiperumal of Olin Corporation if you have any questions about the content of this memorandum.

Sincerely,

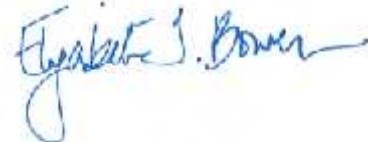
**Wood Environment & Infrastructure Solutions, Inc.**

Prepared by:



**Michael Murphy**  
Principal Risk Assessor

Reviewed by:



**Elizabeth T. Bowen**  
Associate Project Manager

## **TABLES**

Table 1.  
EPA Calculation of Ecological PRGs for Soil from Baseline Ecological Risk Assessment  
Olin Chemical Superfund Site  
Wilmington, MA

Soil Exposure Area	Soil Type	Receptor	Chemical	BERA HQ Table No.	BERA EPC Table No.	RME						Proposed PRG (mg/kg)	
						HQ			EPC (mg/kg)	PRG			
						NOAEL HQ	LOAEL HQ	Geomean		NOAEL (mg/kg)	LOAEL (mg/kg)	Geomean (mg/kg)	
5	Upland	Robin	BEHP	4.5-3	4.1-3	113	11.3	36	103	1	9	3	3
5	Upland	Robin	Chromium	4.5-3	4.1-3	52.4	12.9	26	26344	503	2042	1013	1000
5	Upland	Robin	Tin	4.5-3	4.1-3	19.7	7.92	12	26000	1319.8	3283	2082	
5	Upland	Shrew	BEHP	4.5-3	4.1-3	21	2.1	7	103	5	49	16	
5	Upland	Shrew	Chromium	4.5-3	4.1-3	21.3	1.3	5	26344	1237	20265	5006	
4	Upland	Robin	BEHP	4.5-2	4.1-2	46	4.6	15	30	1	7	2	
2	Upland	Robin	BEHP	4.5-1	4.1-1	170	17	54	110	1	6	2	
2	Upland	Shrew	BEHP	4.5-1	4.1-1	22.3	2.23	7	110	5	49	16	
LSD	Wetland	Wren	BEHP	4.5-5	4.1-11	93.2	9.32	29	602	6	65	20	20
Off-PWD	Wetland	Wren	Chromium	4.5-9	4.1-15	7.13	1.75	4	2400	337	1371	679	600

BERA = Baseline Ecological Risk Assessment

HQ = Hazard Quotient

EPC = Exposure Point Concentration

RME = Reasonable Maximum Exposure

NOAEL = No Observed Adverse Effect Level

LOAEL = Lowest Observed Adverse Effect Level

PRG = Preliminary Remedial Goal

BEHP = Bis(2-Ethylhexyl)phthalate

LSD = Lower South Ditch

Off-PWD = Off Property West Ditch

Prepared by: mjm 3/10/2020

Checked by: cf 3/12/2020

**Table 2.**  
**Preliminary Remediation Goals**  
**Olin Chemical Superfund Site**  
**Wilmington, MA**

<b>Medium</b>	<b>Units</b>	<b>Chromium</b>		<b>BEHP</b>		<b>Ammonia</b>	
		<b>PRG</b>	<b>Basis</b>	<b>PRG</b>	<b>Basis</b>	<b>PRG</b>	<b>Basis</b>
Upland Soil	mg/kg	1000	A	3	E	NA	I
Wetland Soil	mg/kg	600	B	20	F	NA	J
Streambank Soil & Aquatic Sediment	mg/kg	100	C	100	G	NA	K
Surface Water	mg/L	0.1	D	NA	H	15	L

<sup>A</sup> geometric mean of NOAEL-PRG & LOAEL-PRG for robin at EA-5 (1013 mg/kg rounded to 1000 mg/kg)

<sup>B</sup> geometric mean of NOAEL-PRG & LOAEL-PRG for marsh wren at Off-PWD (679 mg/kg rounded to 600 mg/kg)

<sup>C</sup> Probable Effect Concentration (110 mg/kg) and conclusion from REACH dossier (100 mg/kg) rounded to 100 mg/kg

<sup>D</sup> Arithmetic mean of hardness-adjusted CCC at seven water bodies at Site (Table 3.12-3 of BERA)

<sup>E</sup> geometric mean of NOAEL-PRG & LOAEL-PRG for robin at EA-5

<sup>F</sup> geometric mean of NOAEL-PRG & LOAEL-PRG for marsh wren at Lower South Ditch (20 mg/kg rounded to 20 mg/kg)

<sup>G</sup> Conclusion from REACH dossier (<https://echa.europa.eu/registration-dossier/-/registered-dossier/15358/6/1>)

<sup>H</sup> Conclusion from REACH dossier that there is no aquatic toxicity at the solubility limit of BEHP

<sup>I</sup> No data available

<sup>J</sup> No data available

<sup>K</sup> No data available

<sup>L</sup> CCC for Site-specific pH and temperature during Spring months at East Ditch, applied to all surface water at Site

Streambank soil is defined as soil between top of bank on each side of waterbody

Aquatic sediment is defined as sediment that is usually covered with surface water

Soil/sediment PRG compliance = geometric or arithmetic mean ≤ PRG based on data distribution (lognormal or normal, respectively)-for soil, compliance with "accessible" soil

Surface Water PRG compliance = geometric or arithmetic mean ≤ PRG based on data distribution (lognormal or normal, respectively).

REACH = European Regulation on Registration, Evaluation, Authorisation, and Restriction of Chemicals

NA = Not Available

NOAEL = No Observed Adverse Effect Level

LOAEL = Lowest Observed Adverse Effect Level

PRG = Preliminary Remedial Goal

BEHP = bis-2-ethylhexyl phthalate

EA = Exposure Area

off-PWD = Off Property West Ditch

CCC = Criterion Continuous Concentration from EPA National Recommended Water Quality Criteria (NRWQC)

## **ATTACHMENT A**

**A-1. Table 3.12-3 from the Baseline Ecological Risk Assessment**

**A-2. Table 4.1-1 to Table 4.1-15 from the Baseline Ecological Risk Assessment**

**A-3. Table 4.5-1 to Table 4.5-9 from the Baseline Ecological Risk Assessment**

## **Attachment A-1**

### **Table 3.12-3 from the Baseline Ecological Risk Assessment**

**Table 3.12-3**  
**Ecological Surface Water Screening Benchmarks - AWQC Equations**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

Metals	Exposure Area	Hardness [a]	Equation Factors [b]				Freshwater Conversion		Calculated Values (mg/L) [b]			
			mA	bA	mC	bC	CMC	CCC	Total Metals		Dissolved Metals [c]	
									CCC	CMC	CCC	CMC
Cadmium	Off-PWD	61	1.0166	-3.924	0.7409	-4.719			0.00064	0.0012		
	Storm Water Detention Basin	142							0.0012	0.0029		
	Central Pond	528							0.0032	0.011		
	South Ditch	177							0.0014	0.0036		
	Landfill Brook	117							0.0010	0.0023		
	MMB Wetland	72							0.00072	0.0014		
	North Pond	108							0.00097	0.0022		
Chromium	Off-PWD	61	0.819	3.7256	0.819	0.6848	0.316	0.86	0.051	0.61		
	Storm Water Detention Basin	142							0.10	1.2		
	Central Pond	528							0.30	3.6		
	South Ditch	177							0.12	1.5	0.10	0.46
	Landfill Brook	117							0.087	1.0		
	MMB Wetland	72							0.058	0.70		
	North Pond	108							0.081	0.98		
Copper	Off-PWD	61	0.9422	-1.7	0.8545	-1.702			0.0078	0.010		
	Storm Water Detention Basin	142							0.016	0.021		
	Central Pond	528							0.050	0.074		
	South Ditch	177							0.019	0.026		
	Landfill Brook	117							0.014	0.018		
	MMB Wetland	72							0.0090	0.011		
	North Pond	108							0.0128	0.017		
Lead	Off-PWD	61	1.273	-1.46	1.273	-4.705			0.00047	0.029		
	Storm Water Detention Basin	142							0.0014	0.086		
	Central Pond	528							0.0073	0.46		
	South Ditch	177							0.0018	0.11		
	Landfill Brook	117							0.0011	0.067		
	MMB Wetland	72							0.00058	0.036		
	North Pond	108							0.00097	0.060		
Nickel	Off-PWD	61	0.846	2.255	0.846	0.0584			0.034	0.22		
	Storm Water Detention Basin	142							0.070	0.45		
	Central Pond	528							0.21	1.4		
	South Ditch	177							0.084	0.54		
	Landfill Brook	117							0.059	0.38		
	MMB Wetland	72							0.039	0.25		
	North Pond	108							0.055	0.35		
Zinc	Off-PWD	61	0.8473	0.884	0.8473	0.884			0.069	0.069		
	Storm Water Detention Basin	142							0.14	0.14		
	Central Pond	528							0.43	0.43		
	South Ditch	177							0.17	0.17		
	Landfill Brook	117							0.12	0.12		
	MMB Wetland	72							0.079	0.079		
	North Pond	108							0.112	0.112		

**Notes:**

[a] Hardness values are the average (arithmetic mean) for a given exposure area expressed at mg/L CaCO<sub>3</sub>.

[b] Equations used to calculate CCC and CMC values are from USEPA (2013) and are as follows:

Prepared by: SFR 7/10/2013

Checked: EYM 7/15/2013

$$\text{CMC} = \exp[mA / \ln(\text{hardness})] + bA$$

$$\text{CCC} = \exp[mC / \ln(\text{hardness})] + bC$$

Conversion factors for calculating CCC and CMC values for dissolved metals are not applied as all metals concentrations in the data are reported as total metals, with the exception of chromium in South Ditch surface water, for which the conversion is shown.

CCC - Chronic Continuous Concentration

CMC - Chronic Maximum Concentration

mg/L - Milligrams per Liter

**References:**

USEPA. 2013. National Recommended Water Quality Criteria. Office of Water and Office of Science Technology. Last Updated 1/8/2013.

## **Attachment A-2**

### **Table 4.1-1 to Table 4.1-15 from the Baseline Ecological Risk Assessment**

**Table 4.1-1**  
**Selection of EPCs - Soil - Exposure Area 2**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
<b>Volatile Organics (mg/kg)</b>								
Acetaldehyde	2 / 3	0.26	0.2	NC [1]	0.20	MDC	0.20	MDC
<b>Semivolatile Organics (mg/kg)</b>								
Benzaldehyde	7 / 12	2.2	1.9	0.79 NP [1]	0.79	95% UCL	1.9	MDC
Benzo(a)pyrene	6 / 13	0.25	0.24	0.15 NP [2]	0.15	95% UCL	0.24	MDC
Bis(2-Ethylhexyl)phthalate	12 / 17	22	340	110 NP [3]	110	95% UCL	22	Average
Diphenyl ether	1 / 12	2.1	0.12	NC [2]	0.12	MDC	0.12	MDC
Fluoranthene	9 / 17	1.7	0.94	0.40 NP [2]	0.40	95% UCL	0.94	MDC
Phenanthrene	9 / 17	1.8	0.68	0.27 NP [1]	0.27	95% UCL	0.68	MDC
Pyrene	9 / 17	1.7	0.66	0.31 NP [2]	0.31	95% UCL	0.66	MDC
<b>Pesticides (mg/kg)</b>								
4,4'-DDD	1 / 3	0.056	0.039	NC [2]	0.039	MDC	0.039	MDC
4,4'-DDE	1 / 3	0.059	0.049	NC [2]	0.049	MDC	0.049	MDC
4,4'-DDT	1 / 3	0.27	0.68	NC [2]	0.68	MDC	0.27	Average
<b>Metals (mg/kg)</b>								
Aluminum	13 / 13	8,715	24,000	13,090 G [1]	13,090	95% UCL	8,715	Average
Arsenic	13 / 14	6.7	15	8.8 NP [2]	8.8	95% UCL	6.7	Average
Cadmium	9 / 14	0.51	1.1	0.69 NP [4]	0.69	95% UCL	0.51	Average
Chromium	14 / 15	39	275	116 NP [3]	116	95% UCL	39	Average
Copper	12 / 12	17.9	35	22 ND [1]	22	95% UCL	17.9	Average
Iron	13 / 13	10,908	36,000	22,493 NP [5]	22,493	95% UCL	10,908	Average
Lead	13 / 14	40	80	53 NP [2]	53	95% UCL	40	Average
Mercury	8 / 14	0.15	0.35	0.16 NP [2]	0.2	95% UCL	0.15	Average
Selenium	4 / 14	1.1	3.6	2.4 NP [4]	2.4	95% UCL	1.1	Average
Vanadium	12 / 12	24	44	29 G [1]	29	95% UCL	24	Average
Zinc	12 / 12	49	140	70 ND [1]	70	95% UCL	49	Average
<b>Inorganics (mg/kg)</b>								
Chloride	4 / 12	79	550	242 NP [4]	242	95% UCL	79	Average
Nitrogen, as Ammonia	12 / 12	439	1,200	625 ND [1]	625	95% UCL	439	Average

**Table 4.1-1**  
**Selection of EPCs - Soil - Exposure Area 2**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

Prepared by: SFR 7/8/2013  
 Checked by: EYM 7/24/2013

**Notes:**

- [a] COPECs are identified in Table 3.13-1 through Table 3.13-19.
- [b] Arithmetic mean is calculated using one half the detection limits for non-detects.
- [c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated	NP - Nonparametric	G - Gamma	ND - Normal Distribution
[1] Dataset too small to calculate	[1] 95% KM (BCA) UCL	[1] 95% Approximate Gamma	[1] 95% Student's-t UCL
[2] Only one detect	[2] 95% KM (t) UCL		
	[3] 95% KM (Chebyshev) UCL		
	[4] 95% KM (Percentile Bootstrap) UCL		
	[5] 95% Chebyshev (Mean, Sd) UCL		

- [d] The RME EPC is the lesser of the MDC and the 95% UCL.
- [e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern

MDC - Maximum Detected Concentration

UCL - Upper Confidence Limit

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

EPC - Exposure Point Concentration

RME - Reasonable Maximum Exposure

**Table 4.1-2**  
**Selection of EPCs - Soil - Exposure Area 4**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
<b>Volatile Organics (mg/kg)</b>								
Acetaldehyde	1 / 6	0.12	0.046	NC NC [1]	0.046	MDC	0.046	MDC
<b>Semivolatile Organics (mg/kg)</b>								
Benzaldehyde	12 / 14	0.24	1.2	0.61 NP [1]	0.61	95% UCL	0.24	Average
Benzo(a)pyrene	18 / 69	0.33	3.4	0.35 NP [2]	0.35	95% UCL	0.33	Average
Bis(2-Ethylhexyl)phthalate	56 / 76	9.0	200	30 NP [3]	30	95% UCL	9.0	Average
Fluoranthene	24 / 79	0.85	1.9	0.41 NP [1]	0.41	95% UCL	0.85	Average
Naphthalene	4 / 79	0.82	0.21	0.065 NP [2]	0.065	95% UCL	0.21	MDC
Phenanthrene	17 / 79	0.78	0.69	0.14 NP [2]	0.14	95% UCL	0.69	MDC
Pyrene	24 / 78	0.82	1.3	0.22 NP [2]	0.22	95% UCL	0.82	Average
<b>Pesticides (mg/kg)</b>								
4,4'-DDD	6 / 34	0.021	0.16	0.016 NP [2]	0.016	95% UCL	0.021	Average
4,4'-DDE	11 / 34	0.017	0.011	0.0038 NP [2]	0.0038	95% UCL	0.011	MDC
4,4'-DDT	18 / 34	0.025	0.15	0.068 NP [4]	0.068	95% UCL	0.025	Average
Alpha-BHC	3 / 34	0.015	0.0058	0.0020 NP [2]	0.0020	95% UCL	0.0058	MDC
Gamma-BHC/Lindane	5 / 34	0.019	0.13	0.012 NP [2]	0.012	95% UCL	0.019	Average
<b>Metals (mg/kg)</b>								
Aluminum	43 / 43	7,016	59,000	8,804 G [1]	8,804	95% UCL	7,016	Average
Arsenic	40 / 53	7.6	32	9.1 NP [5]	9.1	95% UCL	7.6	Average
Cadmium	18 / 60	0.42	5.8	0.48 NP [6]	0.48	95% UCL	0.42	Average
Chromium	86 / 86	272	5,000	583 NP [7]	583	95% UCL	272	Average
Chromium, Hexavalent	2 / 29	11	95	38 NP[3]	38	95% UCL	11	Average
Cobalt	31 / 34	5.0	45.5	16.2 NP [3]	16.2	95% UCL	5.0	Average
Copper	33 / 34	14	79.5	27 NP[7]	27	95% UCL	14	Average
Iron	43 / 43	8,973	100,000	19,245 NP [7]	19,245	95% UCL	8,973	Average
Lead	59 / 60	24	210	43 NP [1]	43	95% UCL	24	Average
Manganese	34 / 34	84	1035	171 ND [1]	171	95% UCL	84	Average
Mercury	23 / 55	0.12	0.49	0.14 NP [2]	0.14	95% UCL	0.12	Average
Nickel	33 / 34	10	67	25 NP [3]	25	95% UCL	10	Average
Vanadium	34 / 34	17	54	20 G [1]	20	95% UCL	17	Average
Zinc	29 / 34	23	180	48 NP [1]	48	95% UCL	23	Average
<b>Inorganics (mg/kg)</b>								
Chloride	5 / 19	54	560	119 NP [2]	119	95% UCL	54	Average
Cyanide, Total	6 / 7	5.8	9.05	7.9 NP [2]	7.9	95% UCL	5.8	Average
Nitrogen, as Ammonia	32 / 32	262	1,800	356 G [1]	356	95% UCL	262	Average
Sulfate	15 / 27	1,095	23,900	10,004 NP [4]	10,004	95% UCL	1,095	Average
<b>EPH (mg/kg)</b>								
C11-C22 Aromatics	8 / 12	32	130	56 NP [2]	56	95% UCL	32	Average
C19-C36 Aliphatics	7 / 12	42	190	81 NP [5]	81	95% UCL	42	Average
C9-C18 Aliphatics	5 / 12	6.5	17	16.3 NP [5]	16.3	95% UCL	6.5	Average

**Table 4.1-2**  
**Selection of EPCs - Soil - Exposure Area 4**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

Prepared by: SFR 7/8/2013

Checked by: EYM 7/12/2013

Revised: SFR 2/5/2014

**Notes:**

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated

[1] Only one detect

NP - Nonparametric

[1] 95% KM (Chebyshev) UCL

G - Gamma

[1] 95% Approximate Gamma

ND - Normal Distribution

[1] 95% H-UCL

[2] 95% KM (*t*) UCL

[3] 97.5% KM (Chebyshev) UCL

[4] 99% KM (Chebyshev) UCL

[5] 95% KM (Percentile Bootstrap) UCL

[6] 95% KM (BCA) UCL

[7] 95% KM Chebyshev (Mean, Sd) UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern

EPH - Extractable Petroleum Hydrocarbons

RME - Reasonable Maximum Exposure

CTE - Central Tendency Exposure

MDC - Maximum Detected Concentration

UCL - Upper Confidence Limit

EPC - Exposure Point Concentration

mg/kg - milligrams per kilogram

**Table 4.1-3**  
**Selection of EPCs - Soil - Exposure Area 5**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
<b>Volatile Organics (mg/kg)</b>								
Acetaldehyde	3 / 3	0.082	0.13	NC NC [1]	0.13	MDC	0.082	Average
<b>Semivolatile Organics (mg/kg)</b>								
Aniline	1 / 12	12.7	0.12	NC NC [2]	0.12	MDC	0.12	MDC
Benzaldehyde	10 / 10	0.12	0.33	0.21 G [1]	0.21	95% UCL	0.12	Average
Benzo(a)pyrene	4 / 10	0.072	0.44	0.15 NP [1]	0.15	95% UCL	0.072	Average
Bis(2-Ethylhexyl)phthalate	11 / 14	31	216	103 NP [2]	103	95% UCL	31	Average
Diphenyl ether	2 / 10	0.37	1.9	1.9 NP [3]	1.9	95% UCL	0.37	Average
Fluoranthene	10 / 13	0.44	2.6	2.5 NP [4]	2.5	95% UCL	0.44	Average
N-Nitrosodi-n-propylamine	1 / 12	2.5	0.26	NC NC [2]	0.26	MDC	0.26	MDC
Phenanthrene	9 / 13	0.26	0.41	0.15 NP [5]	0.15	95% UCL	0.26	Average
Pyrene	7 / 13	0.28	0.79	0.56 NP [6]	0.56	95% UCL	0.28	Average
<b>Pesticides (mg/kg)</b>								
4,4'-DDT	1 / 1	0.045	0.045	NC NC [1]	0.045	MDC	0.045	Average
Hexachlorobenzene	1 / 1	0.029	0.029	NC NC [1]	0.029	MDC	0.029	Average
<b>Metals (mg/kg)</b>								
Aluminum	9 / 9	10,789	43,000	20,005 G [1]	20,005	95% UCL	10,789	Average
Antimony	2 / 7	0.88	0.34	0.36 NP [1]	0.34	MDC	0.34	MDC
Arsenic	10 / 11	19.4	42	27 NP [1]	27	95% UCL	19.4	Average
Cadmium	6 / 10	0.65	0.52	0.42 NP [1]	0.42	95% UCL	0.52	MDC
Chromium	42 / 43	6,648	62,000	26,344 NP [4]	26,344	95% UCL	6,648	Average
Chromium, Hexavalent	4 / 16	79	1,100	559 NP [6]	559	95% UCL	79	Average
Copper	9 / 9	38	190	97 G [1]	97	95% UCL	38	Average
Iron	9 / 9	14,067	31,000	20,139 ND [1]	20,139	95% UCL	14,067	Average
Lead	11 / 11	71	150	93 ND [1]	93	95% UCL	71	Average
Mercury	10 / 11	0.64	3.1	1.9 NP [2]	1.9	95% UCL	0.64	Average
Silver	2 / 11	103	1,100	1,439 NP [4]	1,100	MDC	103	Average
Thallium	1 / 8	1.9	7.4	NC NC [2]	7.4	MDC	1.9	Average
Tin	8 / 9	2924	26,000	31,853 NP [4]	26,000	MDC	2,924	Average
Vanadium	9 / 9	39	150	69 G [1]	69	95% UCL	39	Average
Zinc	9 / 9	17.0	47	31 G [1]	31	95% UCL	17.0	Average
<b>Inorganics (mg/kg)</b>								
Cyanide, Total	1 / 1	6.5	6.5	NC NC [1]	6.5	MDC	6.5	Average
Nitrogen, as Ammonia	9 / 9	406	1,100	749 ND[2]	749	95% UCL	406	Average
Sulfate	2 / 8	74	230	230 NP [3]	230	95% UCL	74	Average
<b>EPH (mg/kg)</b>								
C11-C22 Aromatics	2 / 2	4450	7,500	NC NC [1]	7,500	MDC	4,450	Average
C19-C36 Aliphatics	2 / 2	3350	4,900	NC NC [1]	4,900	MDC	3,350	Average
C9-C18 Aliphatics	2 / 2	490	780	NC NC [1]	780	MDC	490	Average

**Table 4.1-3**  
**Selection of EPCs - Soil - Exposure Area 5**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

Prepared by: SFR 7/8/2013  
 Checked by: EYM 7/12/2013

**Notes:**

- [a] COPECs are identified in Table 3.13-1 through Table 3.13-19.
- [b] Arithmetic mean is calculated using one half the detection limits for non-detects.
- [c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated

- [1] Dataset too small to calculate
- [2] Only one detect

G - Gamma

- [1] 95% Approximate Gamma

NP - Nonparametric

- [1] 95% KM (t) UCL
- [2] 95% KM (Chebyshev) UCL
- [3] 95% KM (% Bootstrap) UCL
- [4] 99% KM (Chebyshev) UCL
- [5] 95% KM (BCA) UCL
- [6] 97.5% KM (Chebyshev) UCL

ND - Normal Distribution

- [1] 95% Student's-t UCL
- [2] 95% H-UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern

EPH - Extractable Petroleum Hydrocarbons

RME - Reasonable Maximum Exposure

CTE - Central Tendency Exposure

MDC - Maximum Detected Concentration

UCL - Upper Confidence Limit

EPC - Exposure Point Concentration

mg/kg - milligrams per kilogram

**Table 4.1-4**  
**Selection of EPCs - Surface Water - South Ditch**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPECs [a]	Frequency of Detection	Average (arithmetic mean) [b]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
<b>Semivolatile Organics (mg/L)</b>								
Azobenzene	2 / 12	0.0017	0.00053	0.00056 NP [1]	0.00053	MDC	0.00053	MDC
Benzo(a)pyrene	1 / 12	0.00016	0.00015	NC NC [1]	0.00015	MDC	0.00015	MDC
Bis(2-Ethylhexyl)phthalate	2 / 11	0.0024	0.0061	0.0034 NP [1]	0.0034	95% UCL	0.0024	Average
N-Nitrosodi-n-propylamine	2 / 12	0.0000035	0.0000093	0.0000066 NP [1]	0.0000066	95% UCL	0.0000035	Average
<b>Metals, Total (mg/L)</b>								
Aluminum	131 / 132	4.9	280	19 NP [2]	18.9	95% UCL	4.9	Average
Barium	12 / 12	0.024	0.032	0.027 ND [1]	0.027	95% UCL	0.024	Average
Beryllium	5 / 12	0.00061	0.0011	0.00084 NP [1]	0.00084	95% UCL	0.00061	Average
Chromium	132 / 132	1.1	64	3.3 NP [3]	3.3	95% UCL	1.1	Average
Cobalt	12 / 12	0.028	0.05	0.037 ND [1]	0.037	95% UCL	0.028	Average
Copper	12 / 12	0.0090	0.026	0.017 G [1]	0.017	95% UCL	0.0090	Average
Iron	12 / 12	5.9	13	7.9 ND [1]	7.9	95% UCL	5.9	Average
Lead	10 / 12	0.00063	0.0021	0.00094 NP [4]	0.00094	95% UCL	0.00063	Average
Manganese	12 / 12	1.5	2.2	1.8 ND [1]	1.8	95% UCL	1.5	Average
Silver	1 / 12	0.00027	0.000017	NC NC [1]	0.000017	MDC	0.000017	MDC
<b>Metals, Filtered (mg/L)</b>								
Aluminum	131 / 132	0.69	22	1.5 NP [5]	1.528	95% UCL	0.69	Average
Chromium	132 / 132	0.20	5	0.40 NP [3]	0.398	95% UCL	0.20	Average
<b>Inorganics (mg/L)</b>								
Bromide	10 / 12	0.32	0.48	0.40 NP [6]	0.4	95% UCL	0.32	Average
Chloride	132 / 132	164	300	172 G [1]	172	95% UCL	164	Average
Nitrite as N	12 / 126	0.031	0.043	0.021 NP [6]	0.021	95% UCL	0.031	Average
Nitrogen, as Ammonia	132 / 132	56	250	73 NP [3]	73	95% UCL	56	Average

**Table 4.1-4**  
**Selection of EPCs - Surface Water - South Ditch**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

Prepared by: SFR 7/8/2013

Checked by: EYM 7/12/2013

Revised: SFR 2/5/2014

**Notes:**

- [a] COPECs are identified in Table 3.13-1 through Table 3.13-19.
- [b] Arithmetic mean is calculated using one-half the detection limits for non-detects.
- [c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NP - Nonparametric

[1] 95% KM (t) UCL

[2] 97.5% KM Chebyshev

[3] 95% KM Chebyshev (Mean, Sd) UCL

[4] 95% KM (BCA) UCL

[5] 95% KM (Chebyshev) UCL

[6] 95% KM (Percentile Bootstrap) UCL

NC - Not Calculated

[1] Only one detect

G - Gamma Distribution

[1] 95% Approximate Gamma UCL

ND - Normal Distribution

[1] 95% Student's-t UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern

CTE - Central Tendency Exposure

EPC - Exposure Point Concentration

MDC - Maximum Detected Concentration

UCL - Upper Confidence Limit

**Table 4.1-5**  
**Selection of EPCs - Surface Water - Central Pond**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPECs [a]	Frequency of Detection	Average (arithmetic mean) [b]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
<b>Metals, Total (mg/L)</b>								
Aluminum	1 / 1	0.21	0.21	NC NC [1]	0.21	MDC	0.21	Average
Barium	1 / 1	0.049	0.049	NC NC [1]	0.049	MDC	0.049	Average
Manganese	1 / 1	0.7	0.7	NC NC [1]	0.70	MDC	0.70	Average
Silver	1 / 1	0.000015	0.000015	NC NC [1]	0.000015	MDC	0.000015	Average
<b>Inorganics (mg/L)</b>								
Bromide	1 / 1	0.13	0.13	NC NC [1]	0.13	MDC	0.13	Average
Nitrite as N	1 / 1	0.075	0.075	NC NC [1]	0.075	MDC	0.075	Average
Nitrogen, as Ammonia	1 / 1	28	28	NC NC [1]	28	MDC	28	Average

Prepared by: SFR 7/8/2013

Checked by: EYM 7/12/2013

**Notes:**

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated

[1] Only one detect

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern

MDC - Maximum Detected Concentration

UCL - Upper Confidence Limit

CTE - Central Tendency Exposure

mg/L - milligrams per liter

EPC - Exposure Point Concentration

RME - Reasonable Maximum Exposure

**Table 4.1-6**  
**Selection of EPCs - Surface Water - Storm Water Detention Basin**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPECs [a]	Frequency of Detection	Average (arithmetic mean) [b]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
<b>Semivolatile Organics (mg/L)</b>								
N-Nitrosodiphenylamine	1 / 1	0.0000074	0.0000074	NC NC [1]	0.0000074	MDC	0.0000074	Average
<b>Metals, Total (mg/L)</b>								
Aluminum	1 / 1	0.9	0.9	NC NC [1]	0.90	MDC	0.90	Average
Barium	1 / 1	0.026	0.026	NC NC [1]	0.026	MDC	0.026	Average
Iron	1 / 1	1.5	1.5	NC NC [1]	1.5	MDC	1.5	Average
Lead	1 / 1	0.003	0.003	NC NC [1]	0.0030	MDC	0.0030	Average
Silver	1 / 1	0.000056	0.000056	NC NC [1]	0.000056	MDC	0.000056	Average
<b>Inorganics (mg/L)</b>								
Nitrite as N	1 / 1	0.026	0.026	NC NC [1]	0.026	MDC	0.026	Average
Nitrogen, as Ammonia	1 / 1	7.5	7.5	NC NC [1]	7.5	MDC	7.5	Average

Prepared by: SFR 7/8/2013

Checked by: EYM 7/12/2013

**Notes:**

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated

[1] Only one detect

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern

MDC - Maximum Detected Concentration

UCL - Upper Confidence Limit

CTE - Central Tendency Exposure

mg/L - milligrams per liter

EPC - Exposure Point Concentration

RME - Reasonable Maximum Exposure

**Table 4.1-7**  
**Selection of EPCs - Surface Water - Off-PWD**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPECs [a]	Frequency of Detection	Average (arithmetic mean) [b]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
<b>Volatile Organics (mg/L)</b>								
Carbon disulfide	3 / 6	0.0033	0.0025	0.0025 NP [1]	0.0025	MDC	0.0025	MDC
<b>Semivolatile Organics (mg/L)</b>								
3 & 4 Methylphenol	2 / 6	0.0018	0.00076	0.00078 NP [1]	0.00076	MDC	0.00076	MDC
Benzo(a)anthracene	2 / 6	0.00047	0.002	NC NC [1]	0.0020	MDC	0.00047	Average
Benzo(a)pyrene	4 / 6	0.00089	0.0042	0.0023 NP [2]	0.0023	95% UCL	0.00089	Average
Benzo(b)fluoranthene	4 / 6	0.0016	0.0077	0.0040 NP [2]	0.0040	95% UCL	0.0016	Average
Benzo(ghi)perylene	3 / 6	0.00099	0.0046	0.0026 NP [1]	0.0026	95% UCL	0.00099	Average
Benzo(k)fluoranthene	2 / 6	0.00061	0.0026	0.0026 NP [2]	0.0026	95% UCL	0.00061	Average
Chrysene	4 / 6	0.0012	0.0053	0.0027 NP [2]	0.0027	95% UCL	0.0012	Average
Dibenz(a,h)anthracene	1 / 6	0.00039	0.0012	NC NC [2]	0.0012	MDC	0.00039	Average
Indeno(1,2,3-cd)pyrene	3 / 6	0.00088	0.004	0.0040 NP [3]	0.0040	95% UCL	0.00088	Average
Phenanthrene	4 / 6	0.00053	0.0025	0.0013 NP [2]	0.0013	95% UCL	0.00053	Average
Pyrene	4 / 6	0.0031	0.012	0.0063 NP [2]	0.0063	95% UCL	0.0031	Average
<b>Metals, Total (mg/L)</b>								
Aluminum	6 / 6	0.82	1.6	1.3 ND [1]	1.3	95% UCL	0.82	Average
Barium	6 / 6	0.035	0.046	0.041 ND [1]	0.041	95% UCL	0.035	Average
Chromium	6 / 6	0.050	0.13	0.093 ND [1]	0.093	95% UCL	0.050	Average
Iron	6 / 6	16.4	30	25 ND [1]	25	95% UCL	16.4	Average
Lead	6 / 6	0.0027	0.0058	0.0043 ND [1]	0.0043	95% UCL	0.0027	Average
Manganese	6 / 6	0.85	1.5	1.3 ND [1]	1.3	95% UCL	0.85	Average
Zinc	6 / 6	0.038	0.12	0.095 G [1]	0.095	95% UCL	0.038	Average
<b>Inorganics (mg/L)</b>								
Bromide	5 / 6	0.15	0.21	0.20 NP [1]	0.20	95% UCL	0.15	Average
Nitrite as N	1 / 6	0.023	0.02	NC NC [2]	0.020	MDC	0.020	MDC
Nitrogen, as Ammonia	6 / 6	45	66	60 ND [1]	60	95% UCL	45	Average

Prepared by: SFR 7/8/2013

Checked by: EYM 7/12/2013

**Notes:**

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NP - Nonparametric

NC - Not Calculated

ND - Normal Distribution

G - Gamma Distribution

[1] 95% KM (t) UCL

[1] N/A result from ProUCL

[1] 95% Student's-t UCL

[1] 95% Approximate Gamma UCL

[2] 95% KM (BCA) UCL

[2] Only one detect

[3] 95% KM (Percentile Bootstrap) UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern

MDC - Maximum Detected Concentration

UCL - Upper Confidence Limit

CTE - Central Tendency Exposure

mg/L - milligrams per liter

EPC - Exposure Point Concentration

RME - Reasonable Maximum Exposure

**Table 4.1-8**  
**Selection of EPCs - Surface Water - MMB Wetland**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPECs [a]	Frequency of Detection	Average (arithmetic mean) [b]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
<b>Semivolatile Organics (mg/L)</b>								
Benzo(a)pyrene	2 / 22	0.000094	0.00013	0.00014 NP [1]	0.00013	MDC	0.000094	Average
Caprolactam	2 / 22	0.0021	0.00066	NC NC [1]	0.00066	MDC	0.00066	MDC
N-Nitrosodi-n-propylamine	3 / 22	0.0000041	0.00000078	0.00000080 NP [1]	0.00000078	MDC	0.00000078	MDC
<b>Metals, Total (mg/L)</b>								
Aluminum	18 / 22	0.17	1.8	0.68 NP [2]	0.68	95% UCL	0.17	Average
Barium	22 / 22	0.037	0.15	0.046 G [1]	0.046	95% UCL	0.037	Average
Copper	18 / 22	0.0048	0.054	0.015 NP [3]	0.015	95% UCL	0.0048	Average
Iron	22 / 22	3.4	29	9.9 NP [4]	9.9	95% UCL	3.4	Average
Lead	18 / 22	0.0065	0.11	0.038 NP [2]	0.038	95% UCL	0.0065	Average
Manganese	22 / 22	0.91	9.3	2.7 NP [4]	2.7	95% UCL	0.91	Average
<b>Inorganics (mg/L)</b>								
Bromide	2 / 22	0.055	0.12	0.10 NP [1]	0.10	95% UCL	0.055	Average

Prepared by: SFR 7/8/2013

Checked by: EYM 7/12/2013

**Notes:**

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NP - Nonparametric

NC - Not Calculated

[1] 95% KM (t) UCL

[1] Only one detect

[2] 97.5% KM (Chebyshev) UCL

[3] 95% KM (Chebyshev) UCL

G - Gamma Distribution

[4] 95% KM Chebyshev (Mean, Sd) UCL

[1] 95% Approximate Gamma UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern

MDC - Maximum Detected Concentration

UCL - Upper Confidence Limit

CTE - Central Tendency Exposure

mg/L - milligrams per liter

EPC - Exposure Point Concentration

RME - Reasonable Maximum Exposure

**Table 4.1-9**  
**Selection of EPCs - Surface Water - North Pond**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPECs [a]	Frequency of Detection	Average (arithmetic mean) [b]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
<b>Semivolatile Organics (mg/L)</b>								
Benzo(a)anthracene	2 / 4	0.00012	0.00012	NC NC [1]	0.00012	MDC	0.000119	Average
Benzo(a)pyrene	2 / 4	0.00012	0.00017	NC NC [1]	0.00017	MDC	0.00012	Average
Caprolactam	1 / 4	0.0019	0.00033	NC NC [1]	0.00033	MDC	0.00033	MDC
Pyrene	3 / 4	0.00080	0.00039	NC NC [1]	0.00039	MDC	0.00039	MDC
<b>Metals, Total (mg/L)</b>								
Aluminum	3 / 4	0.15	0.22	NC NC [1]	0.22	MDC	0.15	Average
Barium	4 / 4	0.034	0.041	NC NC [1]	0.041	MDC	0.034	Average
Iron	4 / 4	1.9	2.9	NC NC [1]	2.9	MDC	1.9	Average
Lead	4 / 4	0.00093	0.0013	NC NC [1]	0.0013	MDC	0.00093	Average
Manganese	4 / 4	0.39	0.49	NC NC [1]	0.49	MDC	0.39	Average
Silver	1 / 4	0.00038	0.000022	NC NC [1]	0.000022	MDC	0.000022	MDC
<b>Inorganics (mg/L)</b>								
Bromide	2 / 4	0.28	0.65	NC NC [1]	0.65	MDC	0.28	Average
Chloride	4 / 4	190	320	NC NC [1]	320	MDC	190	Average

Prepared by: SFR 2/5/2014

Checked by: LG 2/5/2014

**Notes:**

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated

[1] Dataset too small to calculate

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern

MDC - Maximum Detected Concentration

UCL - Upper Confidence Limit

CTE - Central Tendency Exposure

mg/L - milligrams per liter

EPC - Exposure Point Concentration

RME - Reasonable Maximum Exposure

**Table 4.1-10**  
**Selection of EPCs - Sediment - Upper South Ditch**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
<b>Volatile Organics (mg/kg)</b>								
2,4,4-Trimethyl-1-pentene	2 / 4	0.018	0.037	NC NC [1]	0.037	MDC	0.018	Average
2,4,4-Trimethyl-2-pentene	2 / 4	0.0029	0.003	NC NC [1]	0.0030	MDC	0.0029	Average
4-iso-Propyltoluene	1 / 4	0.0018	0.0026	NC NC [1]	0.0026	MDC	0.0018	Average
Acetaldehyde	3 / 4	0.085	0.083	NC NC [1]	0.083	MDC	0.083	MDC
Formaldehyde	4 / 4	0.75	1.09	NC NC [1]	1.1	MDC	0.75	Average
<b>Semivolatile Organics (mg/kg)</b>								
3 & 4 Methylphenol	3 / 6	1.3	3	3.0 NP [1]	3.0	95% UCL	1.3	Average
Acetophenone	1 / 6	0.43	0.09	NC NC [2]	0.090	MDC	0.090	MDC
Benzaldehyde	3 / 4	0.35	0.62	NC NC [1]	0.62	MDC	0.35	Average
Caprolactam	1 / 4	0.10	0.053	NC NC [1]	0.053	MDC	0.053	MDC
Diphenyl ether	2 / 4	0.15	0.22	NC NC [1]	0.22	MDC	0.15	Average
Di-n-octylphthalate	1 / 6	0.42	0.15	NC NC [2]	0.15	MDC	0.15	MDC
Diphenylmethanone	1 / 4	0.098	0.0305	NC NC [1]	0.031	MDC	0.031	MDC
Phenol	3 / 6	0.72	0.96	0.96 NP [1]	1.0	95% UCL	0.72	Average
<b>Metals (mg/kg)</b>								
Arsenic	6 / 6	5.3	13	10 G [1]	10	95% UCL	5.3	Average
Barium	6 / 6	27	86	70 G [1]	70	95% UCL	27	Average
Beryllium	5 / 6	0.44	1.0	0.71 NP [2]	0.71	95% UCL	0.44	Average
Chromium	30 / 30	405	1,800	926 LN [1]	926	95% UCL	405	Average
Chromium, Hexavalent	3 / 6	7.0	25	25 NP [1]	25	95% UCL	7.0	Average
Iron	30 / 30	12,445	23,000	13,895 ND [1]	13,895	95% UCL	12,445	Average
Silver	4 / 6	7.5	35	19 NP [3]	19	95% UCL	7.5	Average
Vanadium	6 / 6	10	18	15 ND [1]	15	95% UCL	10	Average
<b>Inorganics (mg/kg)</b>								
Chloride	4 / 4	74	140	NC NC [1]	140	MDC	74	Average
Nitrogen, as Ammonia	6 / 6	148	240	215 ND [1]	215	95% UCL	148	Average
Sulfate	4 / 4	469	700	NC NC [1]	700	MDC	469	Average
<b>Specialty Compounds (mg/kg)</b>								
Hydrazine	2 / 4	0.0012	0.00091	NC NC [1]	0.00091	MDC	0.00091	MDC
Dimethylformamide	2 / 4	0.18	0.3	NC NC [1]	0.30	MDC	0.18	Average
<b>EPH (mg/kg)</b>								
C11-C22 Aromatics	4 / 4	17	24	NC NC [1]	24	MDC	17	Average
C19-C36 Aliphatics	4 / 4	29	43	NC NC [1]	43	MDC	29	Average
C9-C18 Aliphatics	1 / 4	26	96	NC NC [1]	96	MDC	26	Average

**Table 4.1-10**  
**Selection of EPCs - Sediment - Upper South Ditch**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

Prepared by: SFR 7/8/2013

Checked by: EYM 7/12/2013

Revised: SFR 2/5/2014

**Notes:**

- [a] COPECs are identified in Table 3.13-1 through Table 3.13-19.
- [b] Arithmetic mean is calculated using one-half the detection limits for non-detects.
- [c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated

- [1] Data set too small to calculate UCL
- [2] Only one detect

ND - Normal Distribution

- [1] 95% Student's-t UCL

LN - Lognormal Distribution

- [1] 95% H-UCL

G - Gamma Distribution

- [1] 95% Approximate Gamma UCL

NP - Nonparametric

- [1] 95% KM (Percentile Bootstrap) UCL
- [2] 95% KM (t) UCL
- [3] 95% KM (BCA) UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern

EPH - Extractable Petroleum Hydrocarbons

RME - Reasonable Maximum Exposure

CTE - Central Tendency Exposure

MDC - Maximum Detected Concentration

UCL - Upper Confidence Limit

EPC - Exposure Point Concentration

mg/kg - milligrams per kilogram

**Table 4.1-11**  
**Selection of EPCs - Sediment - Lower South Ditch**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
<b>Volatile Organics (mg/kg)</b>								
2,4,4-Trimethyl-1-pentene	2 / 3	0.011	0.02	NC NC [1]	0.020	MDC	0.011	Average
2,4,4-Trimethyl-2-pentene	1 / 3	0.0037	0.0035	NC NC [1]	0.0035	MDC	0.0035	MDC
Acetaldehyde	1 / 2	0.11	0.063	NC NC [1]	0.063	MDC	0.063	MDC
Acetone	1 / 3	0.17	0.12	NC NC [1]	0.12	MDC	0.12	MDC
Formaldehyde	2 / 2	0.44	0.6	NC NC [1]	0.60	MDC	0.44	Average
<b>Semivolatile Organics (mg/kg)</b>								
Aniline	1 / 6	3.7	0.23	NC NC [2]	0.23	MDC	0.23	MDC
Benzaldehyde	1 / 3	0.99	0.12	NC NC [1]	0.12	MDC	0.12	MDC
Bis(2-Ethylhexyl)phthalate	6 / 6	322	920	602 ND [1]	602	95% UCL	322	Average
Di-n-octylphthalate	1 / 6	1.1	0.15	NC NC [2]	0.15	MDC	0.15	MDC
Diphenyl ether	2 / 3	1.8	2.6	NC NC [1]	2.6	MDC	1.8	Average
Diphenylamine	1 / 2	0.062	0.095	NC NC [1]	0.095	MDC	0.062	Average
<b>Pesticides (mg/kg)</b>								
4,4'-DDT	1 / 3	0.025	0.062	NC NC [1]	0.062	MDC	0.025	Average
Hexachlorobenzene	1 / 3	0.016	0.037	NC NC [1]	0.037	MDC	0.016	Average
<b>Metals (mg/kg)</b>								
Barium	6 / 6	12.8	23	17.4 ND [1]	17.4	95% UCL	12.8	Average
Beryllium	5 / 6	0.96	1.9	1.5 NP [1]	1.5	95% UCL	0.96	Average
Cadmium	4 / 6	0.56	1.2	1.0 NP [2]	1.0	95% UCL	0.56	Average
Chromium	6 / 6	1,922	3,000	2,764 ND [1]	2,764	95% UCL	1,922	Average
Chromium, Hexavalent	4 / 5	14.5	28	26 NP [2]	26	95% UCL	14.5	Average
Mercury	5 / 6	0.18	0.39	0.29 NP [1]	0.29	95% UCL	0.18	Average
Nickel	6 / 6	14.1	24	19.6 ND [1]	19.6	95% UCL	14.1	Average
Silver	3 / 6	25	62	62 NP [2]	62	95% UCL	25	Average
Tin	1 / 3	3.7	1.6	NC NC [1]	1.6	MDC	1.6	MDC
Vanadium	6 / 6	8.7	14	11.1 ND [1]	11.1	95% UCL	8.7	Average
<b>Inorganics (mg/kg)</b>								
Chloride	3 / 3	133	140	NC NC [1]	140	MDC	133	Average
Nitrogen, as Ammonia	6 / 6	172	290	252 ND [1]	252	95% UCL	172	Average
Sulfate	3 / 3	690	830	NC NC [1]	830	MDC	690	Average
<b>EPH (mg/kg)</b>								
C11-C22 Aromatics	2 / 2	5,250	9,400	NC NC [1]	9,400	MDC	5,250	Average
C19-C36 Aliphatics	2 / 2	3,545	6,400	NC NC [1]	6,400	MDC	3,545	Average
C9-C18 Aliphatics	2 / 2	433	770	NC NC [1]	770	MDC	433	Average
<b>Specialty Compounds (mg/kg)</b>								
Hydrazine	2 / 2	0.0019	0.0024	NC NC [1]	0.0024	MDC	0.0019	Average

**Table 4.1-11**  
**Selection of EPCs - Sediment - Lower South Ditch**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

Prepared by: SFR 7/8/2013  
 Checked by: EYM 7/12/2013

**Notes:**

- [a] COPECs are identified in Table 3.13-1 through Table 3.13-19.
- [b] Arithmetic mean is calculated using one-half the detection limits for non-detects.
- [c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated

- [1] Data set too small to calculate UCL
- [2] Only one detect

ND - Normal Distribution

- [1] 95% Student's-t UCL

NP - Nonparametric

- [1] 95% KM (t) UCL
- [2] 95% KM (Percentile Bootstrap) UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern

CTE - Central Tendency Exposure

EPC - Exposure Point Concentration

EPH - Extractable Petroleum Hydrocarbons

MDC - Maximum Detected Concentration

mg/kg - milligrams per kilogram

RME - Reasonable Maximum Exposure

UCL - Upper Confidence Limit

**Table 4.1-12**  
**Selection of EPCs - Sediment - On-PWD-WDW**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
<b>Volatile Organics (mg/kg)</b>								
Acetone	2 / 8	7.6	0.34	0.45 NP [1]	0.34	MDC	0.34	MDC
<b>Nonionic Organics (mg/kg)</b>								
Benzene	1 / 8	0.93	4.4	NC NC [1]	4.4	MDC	0.93	Average
<b>Metals (mg/kg)</b>								
Barium	3 / 3	18.0	37.6	NC NC [2]	38	MDC	18.0	Average
Beryllium	1 / 3	0.25	0.61	NC NC [2]	0.61	MDC	0.25	Average
Cadmium	4 / 9	0.57	1.2	0.94 NP [2]	0.94	95% UCL	0.57	Average
Chromium	31 / 33	24	69	30 NP [3]	30	95% UCL	24	Average
Lead	8 / 9	50	110	76 NP [1]	76	95% UCL	50	Average
Mercury	5 / 8	0.23	0.44	0.34 NP[2]	0.34	95% UCL	0.23	Average
Vanadium	3 / 3	15.7	27	NC NC [2]	27	MDC	15.7	Average

Prepared by: SFR 7/8/2013

Checked by: EYM 7/12/2013

Revised: SFR 2/5/2014

**Notes:**

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NP - Nonparametric

NC - Not Calculated

[1] 95% KM (t) UCL

[1] Only one detect

[2] 95% KM (Percentile Bootstrap) UCL

[2] Data set too small to calculate UCL

[3] 95% KM (BCA) UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern

MDC - Maximum Detected Concentration

UCL - Upper Confidence Limit

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

EPC - Exposure Point Concentration

RME - Reasonable Maximum Exposure

**Table 4.1-13**  
**Selection of EPCs - Sediment - Central Pond**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
<b>Volatile Organics (mg/kg)</b>								
2,4,4-Trimethyl-1-pentene	1 / 2	0.0068	0.011	NC NC [1]	0.011	MDC	0.0068	Average
2,4,4-Trimethyl-2-pentene	1 / 2	0.0057	0.0088	NC NC [1]	0.0088	MDC	0.0057	Average
Acetone	2 / 2	0.12	0.12	NC NC [1]	0.12	MDC	0.12	Average
Methyl Tertbutyl Ether	1 / 2	0.0016	0.0017	NC NC [1]	0.0017	MDC	0.0016	Average
<b>Semivolatile Organics (mg/kg)</b>								
3 & 4 Methylphenol	2 / 2	5.2	6.1	NC NC [1]	6.1	MDC	5.2	Average
Acetophenone	2 / 2	0.21	0.26	NC NC [1]	0.26	MDC	0.21	Average
Benzaldehyde	2 / 2	1.7	1.9	NC NC [1]	1.9	MDC	1.7	Average
Phenol	2 / 2	2.0	2.2	NC NC [1]	2.2	MDC	2.0	Average
<b>Polyaromatic Hydrocarbons (mg/kg)</b>								
Benzo(b)fluoranthene	1 / 2	0.19	0.14	NC NC [1]	0.14	MDC	0.14	MDC
Fluoranthene	2 / 2	0.25	0.29	NC NC [1]	0.29	MDC	0.25	Average
Phenanthrene	1 / 2	0.22	0.21	NC NC [1]	0.21	MDC	0.21	MDC
Pyrene	2 / 2	0.21	0.23	NC NC [1]	0.23	MDC	0.21	Average
<b>Metals (mg/kg)</b>								
Barium	2 / 2	46	46	NC NC [1]	46	MDC	46	Average
Beryllium	2 / 2	0.092	0.094	NC NC [1]	0.094	MDC	0.092	Average
Chromium	9 / 9	38	140	95 NP [1]	140	MDC	38	Average
Chromium, Hexavalent	2 / 2	0.24	0.27	NC NC [1]	0.27	MDC	0.24	Average
Lead	2 / 2	51	51	NC NC [1]	51	MDC	51	Average
Manganese	2 / 2	515	590	NC NC [1]	590	MDC	515	Average
Tin	2 / 2	2.2	2.2	NC NC [1]	2.2	MDC	2.2	Average
Vanadium	2 / 2	16.5	17	NC NC [1]	17	MDC	16.5	Average
<b>Inorganics (mg/kg)</b>								
Chloride	2 / 2	21	24	NC NC [1]	24	MDC	21	Average
Nitrogen, as Ammonia	2 / 2	26	35	NC NC [1]	35	MDC	26	Average
Sulfate	2 / 2	855	1,200	NC NC [1]	1,200	MDC	855	Average

**Table 4.1-13**  
**Selection of EPCs - Sediment - Central Pond**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

Prepared by: SFR 7/8/2013  
Checked by: EYM 7/12/2013

**Notes:**

- [a] COPECs are identified in Table 3.13-1 through Table 3.13-19.
- [b] Arithmetic mean is calculated using one-half the detection limits for non-detects.
- [c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated

[1] Data set too small to calculate UCL

NP - Nonparametric

[1] 95% Chebyshev (Mean, Sd) UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern

CTE - Central Tendency Exposure

EPC - Exposure Point Concentration

MDC - Maximum Detected Concentration

mg/kg - milligrams per kilogram

RME - Reasonable Maximum Exposure

UCL - Upper Confidence Limit

**Table 4.1-14**  
**Selection of EPCs - Sediment - Storm Water Detention Basin**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
<b>Volatile Organics (mg/kg)</b>								
2,4,4-Trimethyl-1-pentene	2 / 2	0.0051	0.0078	NC NC [1]	0.0078	MDC	0.0051	Average
2,4,4-Trimethyl-2-pentene	2 / 2	0.0027	0.0039	NC NC [1]	0.0039	MDC	0.0027	Average
Acetone	2 / 2	0.14	0.15	NC NC [1]	0.15	MDC	0.14	Average
<b>Semivolatile Organics (mg/kg)</b>								
3 & 4 Methylphenol	2 / 2	2.9	4	NC NC [1]	4.0	MDC	2.9	Average
Acetophenone	1 / 2	0.23	0.16	NC NC [1]	0.16	MDC	0.16	MDC
Benzaldehyde	2 / 2	0.96	1.3	NC NC [1]	1.3	MDC	0.96	Average
Phenol (mg/kg)	2 / 2	1.7	1.9	NC NC [1]	1.9	MDC	1.7	Average
Benzo(a)pyrene	1 / 2	0.24	0.22	NC NC [1]	0.22	MDC	0.22	MDC
<b>Metals (mg/kg)</b>								
Arsenic	2 / 2	10.7	12	NC NC [1]	12.0	MDC	10.7	Average
Barium	2 / 2	50	51	NC NC [1]	51	MDC	50	Average
Beryllium	2 / 2	0.10	0.12	NC NC [1]	0.12	MDC	0.10	Average
Chromium	2 / 2	42	50	NC NC [1]	50	MDC	42	Average
Vanadium	2 / 2	21	22	NC NC [1]	22	MDC	21	Average
<b>Inorganics (mg/kg)</b>								
Chloride	2 / 2	9.7	13	NC NC [1]	13.0	MDC	9.7	Average
Nitrogen, as Ammonia	2 / 2	18.0	22	NC NC [1]	22	MDC	18.0	Average
Sulfate	2 / 2	1,400	1,900	NC NC [1]	1,900	MDC	1,400	Average

Prepared by: SFR 7/8/2013

Checked by: EYM 7/12/2013

**Notes:**

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated

[1] Data set too small to calculate UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern

MDC - Maximum Detected Concentration

UCL - Upper Confidence Limit

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

EPC - Exposure Point Concentration

RME - Reasonable Maximum Exposure

**Table 4.1-15**  
**Selection of EPCs - Sediment - Off-PWD**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
<b>Volatile Organics (mg/kg)</b>								
2,4,4-Trimethyl-1-pentene	1 / 3	0.023	0.06	NC NC [1]	0.060	MDC	0.023	Average
2,4,4-Trimethyl-2-pentene	1 / 3	0.0060	0.008	NC NC [1]	0.0080	MDC	0.0060	Average
Formaldehyde	2 / 2	0.51	0.61	NC NC [1]	0.61	MDC	0.51	Average
<b>Semivolatile Organics (mg/kg)</b>								
4-Chlorophenyl phenyl ether	1 / 3	0.044	0.061	NC NC [1]	0.061	MDC	0.044	Average
Carbazole	3 / 3	0.045	0.051	NC NC [1]	0.051	MDC	0.045	Average
Diphenyl ether	2 / 3	0.33	0.86	NC NC [1]	0.86	MDC	0.33	Average
Diphenylmethanone	2 / 3	0.091	0.2	NC NC [1]	0.20	MDC	0.091	Average
<b>Metals (mg/kg)</b>								
Arsenic	3 / 3	10.0	14	NC NC [1]	14.0	MDC	10.0	Average
Barium	3 / 3	11.7	16	NC NC [1]	16.0	MDC	11.7	Average
Beryllium	3 / 3	1.2	1.4	NC NC [1]	1.4	MDC	1.2	Average
Chromium	3 / 3	1,350	2,400	NC NC [1]	2,400	MDC	1,350	Average
Copper	3 / 3	25	39	NC NC [1]	39	MDC	25	Average
Silver	3 / 3	23.6	41	NC NC [1]	41	MDC	23.6	Average
Vanadium	3 / 3	11.7	15	NC NC [1]	15.0	MDC	11.7	Average
<b>Inorganics (mg/kg)</b>								
Chloride	3 / 3	147	240	NC NC [1]	240	MDC	147	Average
Nitrogen, as Ammonia	3 / 3	254	540	NC NC [1]	540	MDC	254	Average
Sulfate	3 / 3	697	1,500	NC NC [1]	1,500	MDC	697	Average
<b>Specialty Compounds (mg/kg)</b>								
Hydrazine	1 / 2	0.0017	0.0013	NC NC [1]	0.0013	MDC	0.0013	MDC

Prepared by: SFR 7/8/2013

Checked by: EYM 7/12/2013

**Notes:**

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated

[1] Data set too small to calculate UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern

MDC - Maximum Detected Concentration

UCL - Upper Confidence Limit

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

EPC - Exposure Point Concentration

RME - Reasonable Maximum Exposure

### **Attachment A-3**

### **Table 4.5-1 to Table 4.5-9 from the Baseline Ecological Risk Assessment**

**Table 4.5-1**  
**Summary of Food Chain Model Hazard Quotients - Exposure Area 2**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	American Robin											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
<b>Volatile Organics</b>												
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tetrachloroethene	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>Semivolatile Organics</b>												
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzo(a)pyrene	4.E-04	4.E-05	2.E-05	2.E-06	4.E-04	4.E-05	3.E-04	3.E-05	3.E-05	3.E-06	2.E-04	2.E-05
Bis(2-Ethylhexyl)phthalate	<b>3.E+01</b>	<b>3.E+00</b>	2.E-02	2.E-03	<b>3.E+01</b>	<b>3.E+00</b>	<b>2.E+02</b>	<b>2.E+01</b>	3.E-02	3.E-03	<b>1.70.E+02</b>	<b>1.70.E+01</b>
Butylbenzylphthalate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Diphenyl ether	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Fluoranthene	2.E-03	2.E-04	3.E-05	3.E-06	2.E-03	2.E-04	7.E-04	7.E-05	5.E-05	5.E-06	6.E-04	6.E-05
N-Nitrosodiphenylamine	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Phenanthrene	1.E-03	1.E-04	3.E-05	3.E-06	1.E-03	1.E-04	5.E-04	5.E-05	4.E-05	4.E-06	4.E-04	4.E-05
Pyrene	1.E-03	1.E-04	3.E-05	3.E-06	1.E-03	1.E-04	5.E-04	5.E-05	6.E-05	6.E-06	5.E-04	5.E-05
<b>Pesticides</b>												
4,4'-DDD	5.E-03	5.E-04	NC	NC	NC	NC	5.E-03	5.E-04	NC	NC	NC	NC
4,4'-DDE	6.E-03	6.E-04	NC	NC	NC	NC	6.E-03	6.E-04	NC	NC	NC	NC
4,4'-DDT	3.E-02	3.E-03	NC	NC	NC	NC	9.E-02	9.E-03	NC	NC	NC	NC
Alpha-BHC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>Metals</b>												
Aluminum	7.E-01	7.E-02	4.E-01	4.E-02	3.E-01	3.E-02	<b>1.E+00</b>	1.E-01	8.E-01	8.E-02	3.E-01	3.E-02
Antimony	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Arsenic	4.E-02	1.E-02	1.E-02	6.E-03	2.E-02	8.E-03	4.E-02	2.E-02	3.E-02	1.E-02	1.E-02	4.E-03
Cadmium	4.E-02	1.E-02	1.E-02	4.E-03	3.E-02	8.E-03	5.E-02	1.E-02	2.E-02	5.E-03	3.E-02	8.E-03
Chromium	6.E-01	1.E-01	3.E-01	8.E-02	2.E-01	6.E-02	8.E-01	2.E-01	3.E-01	8.E-02	4.E-01	1.E-01
Copper	2.E-02	8.E-03	6.E-03	3.E-03	1.E-02	5.E-03	2.E-02	9.E-03	6.E-03	3.E-03	1.E-02	6.E-03
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	2.E-01	1.E-01	7.E-02	4.E-02	1.E-01	6.E-02	2.E-01	1.E-01	9.E-02	5.E-02	1.E-01	7.E-02
Mercury	4.E-02	2.E-02	3.E-02	1.E-02	9.E-03	4.E-03	2.E-02	1.E-02	5.E-03	3.E-03	2.E-02	8.E-03
Selenium	2.E-01	2.E-01	1.E-01	8.E-02	1.E-01	1.E-01	4.E-01	3.E-01	1.E-01	1.E-01	2.E-01	2.E-01
Vanadium	2.E-01	2.E-02	7.E-02	7.E-03	1.E-01	1.E-02	2.E-01	2.E-02	1.E-01	1.E-02	1.E-01	1.E-02
Zinc	6.E-02	6.E-03	1.E-02	2.E-03	4.E-02	5.E-03	7.E-02	8.E-03	2.E-02	2.E-03	5.E-02	5.E-03
<b>Inorganics</b>												
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

**Notes:**

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

**Shaded and Bolded values indicate HQs > 1**

**Table 4.5-1**  
**Summary of Food Chain Model Hazard Quotients - Exposure Area 2**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	Red-Tailed Hawk											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
<b>Volatile Organics</b>												
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tetrachloroethene	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>Semivolatile Organics</b>												
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzo(a)pyrene	2.E-07	2.E-08	5.E-09	5.E-10	2.E-07	2.E-08	1.E-07	1.E-08	6.E-09	6.E-10	1.E-07	1.E-08
Bis(2-Ethylhexyl)phthalate	4.E-01	4.E-02	1.E-04	1.E-05	4.E-01	4.E-02	2.E+00	2.E-01	2.E-04	2.E-05	1.90.E+00	1.90.E-01
Butylbenzylphthalate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Diphenyl ether	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Fluoranthene	7.E-08	7.E-09	7.E-10	7.E-11	7.E-08	7.E-09	3.E-08	3.E-09	1.E-09	1.E-10	3.E-08	3.E-09
N-Nitrosodiphenylamine	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Phenanthrene	1.E-08	1.E-09	1.E-10	1.E-11	1.E-08	1.E-09	4.E-09	4.E-10	2.E-10	2.E-11	4.E-09	4.E-10
Pyrene	3.E-08	3.E-09	4.E-10	4.E-11	3.E-08	3.E-09	1.E-08	1.E-09	7.E-10	7.E-11	1.E-08	1.E-09
<b>Pesticides</b>												
4,4'-DDD	2.E-06	2.E-07	NC	NC	NC	NC	2.E-06	2.E-07	NC	NC	NC	NC
4,4'-DDE	1.E-05	1.E-06	NC	NC	NC	NC	1.E-05	1.E-06	NC	NC	NC	NC
4,4'-DDT	3.E-05	3.E-06	NC	NC	NC	NC	7.E-05	7.E-06	NC	NC	NC	NC
Alpha-BHC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>Metals</b>												
Aluminum	2.E-04	2.E-05	7.E-05	7.E-06	1.E-04	1.E-05	3.E-04	3.E-05	1.E-04	1.E-05	2.E-04	2.E-05
Antimony	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Arsenic	4.E-05	2.E-05	1.E-05	5.E-06	3.E-05	1.E-05	6.E-05	2.E-05	2.E-05	1.E-05	3.E-05	1.E-05
Cadmium	1.E-05	3.E-06	1.E-06	3.E-07	9.E-06	2.E-06	1.E-05	4.E-06	2.E-06	5.E-07	1.E-05	3.E-06
Chromium	3.E-04	6.E-05	1.E-05	4.E-06	2.E-04	6.E-05	8.E-04	2.E-04	2.E-05	6.E-06	7.E-04	2.E-04
Copper	4.E-05	2.E-05	4.E-06	2.E-06	4.E-05	2.E-05	5.E-05	3.E-05	5.E-06	2.E-06	5.E-05	2.E-05
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	3.E-04	2.E-04	4.E-05	2.E-05	2.E-04	1.E-04	3.E-04	2.E-04	6.E-05	4.E-05	3.E-04	2.E-04
Mercury	1.E-06	7.E-07	3.E-07	1.E-07	1.E-06	6.E-07	2.E-06	8.E-07	4.E-07	2.E-07	1.E-06	6.E-07
Selenium	4.E-05	3.E-05	5.E-06	4.E-06	3.E-05	3.E-05	8.E-05	6.E-05	7.E-06	6.E-06	7.E-05	6.E-05
Vanadium	4.E-05	4.E-06	7.E-06	7.E-07	3.E-05	3.E-06	5.E-05	5.E-06	1.E-05	1.E-06	4.E-05	4.E-06
Zinc	3.E-05	4.E-06	2.E-06	2.E-07	3.E-05	3.E-06	5.E-05	5.E-06	4.E-06	5.E-07	4.E-05	5.E-06
<b>Inorganics</b>												
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

**Notes:**

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

**Shaded and Bolded values indicate HQs > 1**

**Table 4.5-1**  
**Summary of Food Chain Model Hazard Quotients - Exposure Area 2**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	Short-Tailed Shrew											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
<b>Volatile Organics</b>												
Acetaldehyde	1.E-05	1.E-06	NC	NC	NC	NC	1.E-05	1.E-06	NC	NC	NC	NC
Tetrachloroethene	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>Semivolatile Organics</b>												
Benzaldehyde	7.E-05	3.E-05	2.E-06	1.E-06	6.E-05	3.E-05	3.E-05	1.E-05	3.E-06	2.E-06	2.E-05	1.E-05
Benzo(a)pyrene	4.E-01	4.E-02	3.E-02	3.E-03	4.E-01	4.E-02	3.E-01	3.E-02	4.E-02	4.E-03	2.E-01	2.E-02
Bis(2-Ethylhexyl)phthalate	<b>5.E+00</b>	5.E-01	4.E-03	4.E-04	<b>5.E+00</b>	5.E-01	<b>2.E+01</b>	<b>2.E+00</b>	6.E-03	6.E-04	<b>2.23.E+01</b>	<b>2.23.E+00</b>
Butylbenzylphthalate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Diphenyl ether	6.E-02	6.E-03	NC	NC	NC	NC	6.E-02	6.E-03	NC	NC	NC	NC
Fluoranthene	6.E-02	3.E-02	2.E-03	8.E-04	6.E-02	3.E-02	2.E-02	1.E-02	3.E-03	1.E-03	2.E-02	1.E-02
N-Nitrosodiphenylamine	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Phenanthrene	1.E+00	1.E-01	5.E-02	5.E-03	1.E+00	1.E-01	6.E-01	6.E-02	8.E-02	8.E-03	5.E-01	5.E-02
Pyrene	7.E-02	4.E-02	3.E-03	2.E-03	7.E-02	4.E-02	3.E-02	2.E-02	5.E-03	3.E-03	3.E-02	2.E-02
<b>Pesticides</b>												
4,4'-DDD	8.E-02	2.E-02	NC	NC	NC	NC	8.E-02	2.E-02	NC	NC	NC	NC
4,4'-DDE	1.E-01	2.E-02	NC	NC	NC	NC	1.E-01	2.E-02	NC	NC	NC	NC
4,4'-DDT	6.E-01	1.E-01	NC	NC	NC	NC	1.E+00	3.E-01	NC	NC	NC	NC
Alpha-BHC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>Metals</b>												
Aluminum	<b>2.E+01</b>	<b>2.E+00</b>	<b>2.E+01</b>	<b>2.E+00</b>	<b>3.E+00</b>	3.E-01	<b>3.E+01</b>	<b>3.E+00</b>	<b>3.E+01</b>	<b>3.E+00</b>	2.E-01	2.E-02
Antimony	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Arsenic	1.E+00	1.E-01	7.E-01	7.E-02	5.E-01	5.E-02	1.E+00	1.E-01	1.E+00	1.E-01	-4.E-02	-4.E-03
Cadmium	3.E-02	7.E-03	1.E-02	3.E-03	1.E-02	4.E-03	3.E-02	9.E-03	2.E-02	5.E-03	2.E-02	4.E-03
Chromium	5.E-01	3.E-02	5.E-01	3.E-02	2.E-02	1.E-03	6.E-01	3.E-02	5.E-01	3.E-02	8.E-02	-2.E-04
Copper	2.E-02	2.E-03	8.E-03	8.E-04	7.E-03	7.E-04	2.E-02	2.E-03	9.E-03	9.E-04	8.E-03	8.E-04
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	1.E-01	4.E-03	8.E-02	2.E-03	6.E-02	2.E-03	2.E-01	5.E-03	1.E-01	3.E-03	6.E-02	2.E-03
Mercury	2.E-02	2.E-03	2.E-02	2.E-03	-1.E-03	-1.E-04	8.E-03	8.E-04	2.E-03	2.E-04	6.E-03	6.E-04
Selenium	2.E-01	1.E-01	1.E-01	7.E-02	7.E-02	4.E-02	3.E-01	2.E-01	1.E-01	8.E-02	1.E-01	7.E-02
Vanadium	5.E-01	5.E-02	2.E-01	2.E-02	2.E-01	2.E-02	6.E-01	6.E-02	4.E-01	4.E-02	2.E-01	2.E-02
Zinc	6.E-03	2.E-03	3.E-03	8.E-04	4.E-03	1.E-03	8.E-03	2.E-03	4.E-03	1.E-03	4.E-03	1.E-03
<b>Inorganics</b>												
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

**Notes:**

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC - Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

**Shaded and Bolded values indicate HQs > 1**

**Table 4.5-1**  
**Summary of Food Chain Model Hazard Quotients - Exposure Area 2**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	Red Fox											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
<b>Volatile Organics</b>												
Acetaldehyde	1.E-08	1.E-09	NC	NC	NC	NC	1.E-08	1.E-09	NC	NC	NC	NC
Tetrachloroethene	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>Semivolatile Organics</b>												
Benzaldehyde	6.E-08	3.E-08	7.E-10	4.E-10	6.E-08	3.E-08	3.E-08	1.E-08	1.E-09	6.E-10	2.E-08	1.E-08
Benzo(a)pyrene	8.E-05	8.E-06	2.E-06	2.E-07	8.E-05	8.E-06	5.E-05	5.E-06	3.E-06	3.E-07	5.E-05	5.E-06
Bis(2-Ethylhexyl)phthalate	1.E-02	1.E-03	3.E-06	3.E-07	1.E-02	1.E-03	5.E-02	5.E-03	5.E-06	5.E-07	5.E-02	5.E-03
Butylbenzylphthalate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Diphenyl ether	2.E-06	2.E-07	NC	NC	NC	NC	2.E-06	2.E-07	NC	NC	NC	NC
Fluoranthene	3.E-06	1.E-06	3.E-08	1.E-08	3.E-06	1.E-06	1.E-06	6.E-07	5.E-08	2.E-08	1.E-06	6.E-07
N-Nitrosodiphenylamine	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Phenanthrene	5.E-05	5.E-06	6.E-07	6.E-08	5.E-05	5.E-06	2.E-05	2.E-06	1.E-06	1.E-07	2.E-05	2.E-06
Pyrene	3.E-06	2.E-06	4.E-08	3.E-08	3.E-06	2.E-06	1.E-06	8.E-07	8.E-08	5.E-08	1.E-06	7.E-07
<b>Pesticides</b>												
4,4'-DDD	1.E-05	3.E-06	NC	NC	NC	NC	1.E-05	3.E-06	NC	NC	NC	NC
4,4'-DDE	8.E-05	2.E-05	NC	NC	NC	NC	8.E-05	2.E-05	NC	NC	NC	NC
4,4'-DDT	2.E-04	4.E-05	NC	NC	NC	NC	5.E-04	1.E-04	NC	NC	NC	NC
Alpha-BHC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>Metals</b>												
Aluminum	1.E-02	1.E-03	3.E-03	3.E-04	7.E-03	7.E-04	2.E-02	2.E-03	5.E-03	5.E-04	1.E-02	1.E-03
Antimony	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Arsenic	1.E-03	1.E-04	2.E-04	2.E-05	8.E-04	8.E-05	1.E-03	1.E-04	5.E-04	5.E-05	8.E-04	8.E-05
Cadmium	1.E-05	4.E-06	3.E-06	7.E-07	1.E-05	3.E-06	2.E-05	4.E-06	3.E-06	9.E-07	1.E-05	3.E-06
Chromium	6.E-05	3.E-06	2.E-05	9.E-07	4.E-05	2.E-06	1.E-04	6.E-06	2.E-05	1.E-06	9.E-05	5.E-06
Copper	2.E-05	2.E-06	3.E-06	3.E-07	2.E-05	2.E-06	3.E-05	3.E-06	3.E-06	3.E-07	2.E-05	2.E-06
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	9.E-05	3.E-06	2.E-05	5.E-07	8.E-05	2.E-06	1.E-04	3.E-06	2.E-05	7.E-07	9.E-05	3.E-06
Mercury	9.E-07	9.E-08	3.E-07	3.E-08	6.E-07	6.E-08	7.E-07	7.E-08	2.E-07	2.E-08	5.E-07	5.E-08
Selenium	9.E-05	5.E-05	2.E-05	1.E-05	7.E-05	4.E-05	1.E-04	7.E-05	2.E-05	1.E-05	1.E-04	5.E-05
Vanadium	2.E-04	2.E-05	4.E-05	4.E-06	2.E-04	2.E-05	3.E-04	3.E-05	7.E-05	7.E-06	2.E-04	2.E-05
Zinc	2.E-06	6.E-07	3.E-07	9.E-08	2.E-06	5.E-07	3.E-06	7.E-07	4.E-07	1.E-07	2.E-06	6.E-07
<b>Inorganics</b>												
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

**Notes:**

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

**Shaded and Bolded values indicate HQs > 1**

Prepared by: EYM 7/16/2013

Checked by: SFR 7/18/2013

Checked by: EYM 7/24/2013

Revised: SFR 2/25/2014

**Table 4.5-2**  
**Summary of Food Chain Model Hazard Quotients - Exposure Area 4**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	American Robin											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
<b>Volatile Organics</b>												
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>Semivolatile Organics</b>												
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzo(a)pyrene	6.E-04	6.E-05	2.E-05	2.E-06	6.E-04	6.E-05	6.E-04	6.E-05	3.E-05	3.E-06	6.E-04	6.E-05
Bis(2-Ethylhexyl)phthalate	<b>1.E+01</b>	1.E+00	2.E-02	2.E-03	<b>1.E+01</b>	1.E+00	<b>5.E+01</b>	<b>5.E+00</b>	3.E-02	3.E-03	<b>4.60.E+01</b>	<b>4.60.E+00</b>
Fluoranthene	1.E-03	1.E-04	3.E-05	3.E-06	1.E-03	1.E-04	7.E-04	7.E-05	5.E-05	5.E-06	7.E-04	7.E-05
Naphthalene	6.E-02	6.E-03	NC	NC	NC	NC	2.E-02	2.E-03	NC	NC	NC	NC
Phenanthrene	1.E-03	1.E-04	3.E-05	3.E-06	1.E-03	1.E-04	2.E-04	2.E-05	4.E-05	4.E-06	2.E-04	2.E-05
Pyrene	1.E-03	1.E-04	3.E-05	3.E-06	1.E-03	1.E-04	4.E-04	4.E-05	6.E-05	6.E-06	3.E-04	3.E-05
<b>Pesticides</b>												
4,4'-DDD	3.E-03	3.E-04	NC	NC	NC	NC	2.E-03	2.E-04	NC	NC	NC	NC
4,4'-DDE	1.E-03	1.E-04	NC	NC	NC	NC	5.E-04	5.E-05	NC	NC	NC	NC
4,4'-DDT	3.E-03	3.E-04	NC	NC	NC	NC	9.E-03	9.E-04	NC	NC	NC	NC
Alpha-BHC	5.E-03	5.E-04	NC	NC	NC	NC	2.E-03	2.E-04	NC	NC	NC	NC
Gamma-BHC/Lindane	2.E-02	2.E-03	NC	NC	NC	NC	1.E-02	1.E-03	NC	NC	NC	NC
<b>Metals</b>												
Aluminum	6.E-01	6.E-02	4.E-01	4.E-02	1.E-01	1.E-02	7.E-01	7.E-02	8.E-01	8.E-02	-3.E-02	-3.E-03
Arsenic	4.E-02	1.E-02	1.E-02	6.E-03	2.E-02	9.E-03	4.E-02	2.E-02	3.E-02	1.E-02	1.E-02	4.E-03
Cadmium	4.E-02	1.E-02	1.E-02	4.E-03	2.E-02	6.E-03	4.E-02	1.E-02	2.E-02	5.E-03	2.E-02	5.E-03
Chromium	1.E+00	3.E-01	3.E-01	8.E-02	9.E-01	2.E-01	<b>2.E+00</b>	5.E-01	3.E-01	8.E-02	<b>1.75.E+00</b>	4.29.E-01
Chromium, Hexavalent	8.E-01	8.E-02	NC	NC	NC	NC	9.E-01	9.E-02	NC	NC	NC	NC
Cobalt	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Copper	1.E-02	7.E-03	6.E-03	3.E-03	8.E-03	4.E-03	2.E-02	1.E-02	6.E-03	3.E-03	2.E-02	8.E-03
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	1.E-01	7.E-02	7.E-02	4.E-02	6.E-02	3.E-02	2.E-01	1.E-01	9.E-02	5.E-02	9.E-02	5.E-02
Manganese	1.E-03	1.E-04	3.E-04	3.E-05	7.E-04	7.E-05	2.E-03	2.E-04	6.E-04	6.E-05	1.E-03	1.E-04
Mercury	5.E-02	2.E-02	3.E-02	1.E-02	2.E-02	9.E-03	5.E-02	3.E-02	5.E-03	3.E-03	5.E-02	2.E-02
Nickel	4.E-02	3.E-02	1.E-02	8.E-03	3.E-02	2.E-02	1.E-01	7.E-02	2.E-02	1.E-02	8.E-02	5.E-02
Vanadium	1.E-01	1.E-02	7.E-02	7.E-03	7.E-02	7.E-03	2.E-01	2.E-02	1.E-01	1.E-02	5.E-02	5.E-03
Zinc	3.E-02	4.E-03	1.E-02	2.E-03	2.E-02	2.E-03	5.E-02	6.E-03	2.E-02	2.E-03	3.E-02	4.E-03
<b>Inorganics</b>												
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cyanide, Total	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>EPH</b>												
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

**Notes:**

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC - Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

**Shaded and Bolded values indicate HQs > 1**

**Table 4.5-2**  
**Summary of Food Chain Model Hazard Quotients - Exposure Area 4**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	Red-Tailed Hawk											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
<b>Volatile Organics</b>												
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>Semivolatile Organics</b>												
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzo(a)pyrene	2.E-06	2.E-07	5.E-09	5.E-10	2.E-06	2.E-07	2.E-06	2.E-07	6.E-09	6.E-10	2.E-06	2.E-07
Bis(2-Ethylhexyl)phthalate	1.E+00	1.E-01	1.E-04	1.E-05	1.E+00	1.E-01	4.E+00	4.E-01	2.E-04	2.E-05	4.E+00	4.E-01
Fluoranthene	5.E-07	5.E-08	7.E-10	7.E-11	5.E-07	5.E-08	2.E-07	2.E-08	1.E-09	1.E-10	2.E-07	2.E-08
Naphthalene	5.E-07	5.E-08	NC	NC	NC	NC	2.E-07	2.E-08	NC	NC	NC	NC
Phenanthrene	8.E-08	8.E-09	1.E-10	1.E-11	8.E-08	8.E-09	2.E-08	2.E-09	2.E-10	2.E-11	2.E-08	2.E-09
Pyrene	2.E-07	2.E-08	4.E-10	4.E-11	2.E-07	2.E-08	6.E-08	6.E-09	7.E-10	7.E-11	6.E-08	6.E-09
<b>Pesticides</b>												
4,4'-DDD	6.E-06	6.E-07	NC	NC	NC	NC	5.E-06	5.E-07	NC	NC	NC	NC
4,4'-DDE	2.E-05	2.E-06	NC	NC	NC	NC	6.E-06	6.E-07	NC	NC	NC	NC
4,4'-DDT	2.E-05	2.E-06	NC	NC	NC	NC	5.E-05	5.E-06	NC	NC	NC	NC
Alpha-BHC	8.E-08	8.E-09	NC	NC	NC	NC	3.E-08	3.E-09	NC	NC	NC	NC
Gamma-BHC/Lindane	2.E-07	2.E-08	NC	NC	NC	NC	1.E-07	1.E-08	NC	NC	NC	NC
<b>Metals</b>												
Aluminum	1.E-03	1.E-04	7.E-05	7.E-06	1.E-03	1.E-04	2.E-03	2.E-04	1.E-04	1.E-05	1.E-03	1.E-04
Arsenic	4.E-04	1.E-04	1.E-05	5.E-06	3.E-04	1.E-04	4.E-04	2.E-04	2.E-05	1.E-05	4.E-04	2.E-04
Cadmium	6.E-05	2.E-05	1.E-06	3.E-07	6.E-05	2.E-05	6.E-05	2.E-05	2.E-06	5.E-07	6.E-05	2.E-05
Chromium	1.E-02	3.E-03	1.E-05	4.E-06	1.E-02	3.E-03	3.E-02	7.E-03	2.E-05	6.E-06	3.E-02	7.E-03
Chromium, Hexavalent	8.E-04	8.E-05	NC	NC	NC	NC	3.E-03	3.E-04	NC	NC	NC	NC
Cobalt	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Copper	2.E-04	1.E-04	4.E-06	2.E-06	2.E-04	1.E-04	4.E-04	2.E-04	5.E-06	2.E-06	4.E-04	2.E-04
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	1.E-03	6.E-04	4.E-05	2.E-05	1.E-03	6.E-04	2.E-03	1.E-03	6.E-05	4.E-05	2.E-03	1.E-03
Manganese	1.E-06	1.E-07	2.E-08	2.E-09	1.E-06	1.E-07	3.E-06	3.E-07	6.E-08	6.E-09	3.E-06	3.E-07
Mercury	8.E-06	4.E-06	3.E-07	1.E-07	8.E-06	4.E-06	1.E-05	5.E-06	4.E-07	2.E-07	1.E-05	5.E-06
Nickel	2.E-05	2.E-05	4.E-07	3.E-07	2.E-05	2.E-05	5.E-05	4.E-05	8.E-07	6.E-07	5.E-05	4.E-05
Vanadium	2.E-04	2.E-05	7.E-06	7.E-07	2.E-04	2.E-05	2.E-04	2.E-05	1.E-05	1.E-06	2.E-04	2.E-05
Zinc	1.E-04	1.E-05	2.E-06	2.E-07	1.E-04	1.E-05	2.E-04	2.E-05	4.E-06	5.E-07	2.E-04	2.E-05
<b>Inorganics</b>												
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cyanide, Total	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>EPH</b>												
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

**Notes:**

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC - Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

**Shaded and Bolded values indicate HQs > 1**

**Table 4.5-2**  
**Summary of Food Chain Model Hazard Quotients - Exposure Area 4**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	Short-Tailed Shrew											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
<b>Volatile Organics</b>												
Acetaldehyde	3.E-06	3.E-07	NC	NC	NC	NC	3.E-06	3.E-07	NC	NC	NC	NC
<b>Semivolatile Organics</b>												
Benzaldehyde	8.E-06	4.E-06	2.E-06	1.E-06	6.E-06	3.E-06	2.E-05	1.E-05	3.E-06	2.E-06	2.E-05	9.E-06
Benzo(a)pyrene	6.E-01	6.E-02	3.E-02	3.E-03	5.E-01	5.E-02	6.E-01	6.E-02	4.E-02	4.E-03	6.E-01	6.E-02
Bis(2-Ethylhexyl)phthalate	<b>2.E+00</b>	2.E-01	4.E-03	4.E-04	<b>2.E+00</b>	2.E-01	<b>6.E+00</b>	6.E-01	6.E-03	6.E-04	<b>6.03.E+00</b>	6.02.E-01
Fluoranthene	5.E-02	3.E-02	2.E-03	8.E-04	5.E-02	3.E-02	3.E-02	1.E-02	3.E-03	1.E-03	2.E-02	1.E-02
Naphthalene	1.E-02	1.E-03	NC	NC	NC	NC	3.E-03	3.E-04	NC	NC	NC	NC
Phenanthrene	<b>2.E+00</b>	2.E-01	5.E-02	5.E-03	1.E+00	1.E-01	3.E-01	3.E-02	8.E-02	8.E-03	2.E-01	2.E-02
Pyrene	8.E-02	5.E-02	3.E-03	2.E-03	8.E-02	5.E-02	2.E-02	1.E-02	5.E-03	3.E-03	2.E-02	1.E-02
<b>Pesticides</b>												
4,4'-DDD	4.E-02	9.E-03	NC	NC	NC	NC	3.E-02	7.E-03	NC	NC	NC	NC
4,4'-DDE	3.E-02	5.E-03	NC	NC	NC	NC	9.E-03	2.E-03	NC	NC	NC	NC
4,4'-DDT	6.E-02	1.E-02	NC	NC	NC	NC	1.E-01	3.E-02	NC	NC	NC	NC
Alpha-BHC	2.E-03	4.E-04	NC	NC	NC	NC	6.E-04	2.E-04	NC	NC	NC	NC
Gamma-BHC/Lindane	6.E-03	3.E-03	NC	NC	NC	NC	4.E-03	2.E-03	NC	NC	NC	NC
<b>Metals</b>												
Aluminum	<b>2.E+01</b>	<b>2.E+00</b>	<b>2.E+01</b>	<b>2.E+00</b>	-8.E-01	-8.E-02	<b>2.E+01</b>	<b>2.E+00</b>	<b>3.E+01</b>	<b>3.E+00</b>	-9.E+00	-9.E-01
Arsenic	1.E+00	1.E-01	7.E-01	7.E-02	6.E-01	6.E-02	1.E+00	1.E-01	1.E+00	1.E-01	-5.E-02	-5.E-03
Cadmium	2.E-02	6.E-03	1.E-02	3.E-03	1.E-02	3.E-03	3.E-02	7.E-03	2.E-02	5.E-03	8.E-03	2.E-03
Chromium	7.E-01	4.E-02	5.E-01	3.E-02	2.E-01	1.E-02	1.E+00	6.E-02	5.E-01	3.E-02	5.E-01	3.E-02
Chromium, Hexavalent	9.E-02	9.E-02	NC	NC	NC	NC	3.E-01	3.E-01	NC	NC	NC	NC
Cobalt	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Copper	1.E-02	1.E-03	8.E-03	8.E-04	5.E-03	5.E-04	2.E-02	2.E-03	9.E-03	9.E-04	1.E-02	1.E-03
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	1.E-01	3.E-03	8.E-02	2.E-03	2.E-02	7.E-04	1.E-01	5.E-03	1.E-01	3.E-03	4.E-02	1.E-03
Manganese	5.E-03	2.E-03	3.E-03	9.E-04	2.E-03	8.E-04	8.E-03	3.E-03	5.E-03	1.E-03	4.E-03	1.E-03
Mercury	2.E-02	2.E-03	2.E-02	2.E-03	3.E-03	3.E-04	2.E-02	2.E-03	2.E-03	2.E-04	2.E-02	2.E-03
Nickel	7.E-02	4.E-02	3.E-02	1.E-02	4.E-02	2.E-02	2.E-01	9.E-02	5.E-02	3.E-02	1.E-01	6.E-02
Vanadium	3.E-01	3.E-02	2.E-01	2.E-02	1.E-01	1.E-02	4.E-01	4.E-02	4.E-01	4.E-02	-1.E-02	-1.E-03
Zinc	4.E-03	1.E-03	3.E-03	8.E-04	2.E-03	5.E-04	6.E-03	2.E-03	4.E-03	1.E-03	2.E-03	7.E-04
<b>Inorganics</b>												
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cyanide, Total	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>EPH</b>												
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

**Notes:**

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC - Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

**Shaded and Bolded values indicate HQs > 1**

**Table 4.5-2**  
**Summary of Food Chain Model Hazard Quotients - Exposure Area 4**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	Red Fox											
	CTE				RME							
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
<b>Volatile Organics</b>												
Acetaldehyde	2.E-08	2.E-09	NC	NC	NC	NC	2.E-08	2.E-09	NC	NC	NC	NC
<b>Semivolatile Organics</b>												
Benzaldehyde	5.E-08	3.E-08	7.E-10	4.E-10	5.E-08	3.E-08	1.E-07	7.E-08	1.E-09	6.E-10	1.E-07	7.E-08
Benzo(a)pyrene	8.E-04	8.E-05	2.E-06	2.E-07	8.E-04	8.E-05	8.E-04	8.E-05	3.E-06	3.E-07	8.E-04	8.E-05
Bis(2-Ethylhexyl)phthalate	3.E-02	3.E-03	3.E-06	3.E-07	3.E-02	3.E-03	1.E-01	1.E-02	5.E-06	5.E-07	1.E-01	1.E-02
Fluoranthene	2.E-05	9.E-06	3.E-08	1.E-08	2.E-05	9.E-06	9.E-06	4.E-06	5.E-08	2.E-08	9.E-06	4.E-06
Naphthalene	2.E-06	2.E-07	NC	NC	NC	NC	8.E-07	8.E-08	NC	NC	NC	NC
Phenanthrene	4.E-04	4.E-05	6.E-07	6.E-08	4.E-04	4.E-05	8.E-05	8.E-06	1.E-06	1.E-07	7.E-05	7.E-06
Pyrene	2.E-05	1.E-05	4.E-08	3.E-08	2.E-05	1.E-05	7.E-06	4.E-06	8.E-08	5.E-08	7.E-06	4.E-06
<b>Pesticides</b>												
4,4'-DDD	5.E-05	1.E-05	NC	NC	NC	NC	4.E-05	8.E-06	NC	NC	NC	NC
4,4'-DDE	1.E-04	2.E-05	NC	NC	NC	NC	4.E-05	8.E-06	NC	NC	NC	NC
4,4'-DDT	1.E-04	3.E-05	NC	NC	NC	NC	4.E-04	8.E-05	NC	NC	NC	NC
Alpha-BHC	4.E-07	1.E-07	NC	NC	NC	NC	1.E-07	4.E-08	NC	NC	NC	NC
Gamma-BHC/Lindane	1.E-06	7.E-07	NC	NC	NC	NC	8.E-07	4.E-07	NC	NC	NC	NC
<b>Metals</b>												
Aluminum	6.E-02	6.E-03	3.E-03	3.E-04	5.E-02	5.E-03	7.E-02	7.E-03	5.E-03	5.E-04	7.E-02	7.E-03
Arsenic	8.E-03	8.E-04	2.E-04	2.E-05	8.E-03	8.E-04	9.E-03	9.E-04	5.E-04	5.E-05	8.E-03	8.E-04
Cadmium	9.E-05	2.E-05	3.E-06	7.E-07	8.E-05	2.E-05	9.E-05	2.E-05	3.E-06	9.E-07	9.E-05	2.E-05
Chromium	2.E-03	1.E-04	2.E-05	9.E-07	2.E-03	1.E-04	4.E-03	2.E-04	2.E-05	1.E-06	4.E-03	2.E-04
Chromium, Hexavalent	2.E-05	2.E-05	NC	NC	NC	NC	4.E-05	4.E-05	NC	NC	NC	NC
Cobalt	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Copper	1.E-04	1.E-05	3.E-06	3.E-07	1.E-04	1.E-05	2.E-04	2.E-05	3.E-06	3.E-07	2.E-04	2.E-05
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	4.E-04	1.E-05	2.E-05	5.E-07	4.E-04	1.E-05	7.E-04	2.E-05	2.E-05	7.E-07	6.E-04	2.E-05
Manganese	2.E-05	5.E-06	3.E-07	9.E-08	2.E-05	5.E-06	3.E-05	1.E-05	7.E-07	2.E-07	3.E-05	1.E-05
Mercury	6.E-06	6.E-07	3.E-07	3.E-08	6.E-06	6.E-07	7.E-06	7.E-07	2.E-07	2.E-08	7.E-06	7.E-07
Nickel	3.E-05	1.E-05	1.E-06	5.E-07	3.E-05	1.E-05	7.E-05	4.E-05	1.E-06	7.E-07	7.E-05	4.E-05
Vanadium	1.E-03	1.E-04	4.E-05	4.E-06	1.E-03	1.E-04	1.E-03	1.E-04	7.E-05	7.E-06	1.E-03	1.E-04
Zinc	9.E-06	3.E-06	3.E-07	9.E-08	9.E-06	3.E-06	1.E-05	4.E-06	4.E-07	1.E-07	1.E-05	4.E-06
<b>Inorganics</b>												
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cyanide, Total	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>EPH</b>												
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

**Notes:**

Prepared by: EYM 7/16/2013

CTE - Central Tendency Exposure

Checked by: SFR 7/18/2013

COPEC - Chemical of Potential Ecological Concern

Revised: SFR 2/25/2014

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC - Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

**Shaded and Bolded values indicate HQs > 1**

**Table 4.5-3**  
**Summary of Food Chain Model Hazard Quotients - Exposure Area 5**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	American Robin											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
<b>Volatile Organics</b>												
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>Semivolatile Organics</b>												
Aniline	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzo(a)pyrene	9.E-05	9.E-06	2.E-05	2.E-06	7.E-05	7.E-06	2.E-04	2.E-05	3.E-05	3.E-06	2.E-04	2.E-05
Bis(2-Ethylhexyl)phthalate	<b>3.E+01</b>	<b>3.E+00</b>	2.E-02	2.E-03	<b>3.E+01</b>	<b>3.E+00</b>	<b>1.E+02</b>	<b>1.E+01</b>	3.E-02	3.E-03	<b>1.13.E+02</b>	<b>1.13.E+01</b>
Diphenyl ether	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Fluoranthene	5.E-04	5.E-05	3.E-05	3.E-06	5.E-04	5.E-05	3.E-03	3.E-04	5.E-05	5.E-06	3.E-03	3.E-04
N-Nitrosodi-n-propylamine	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Phenanthrene	3.E-04	3.E-05	3.E-05	3.E-06	3.E-04	3.E-05	2.E-04	2.E-05	4.E-05	4.E-06	1.E-04	1.E-05
Pyrene	3.E-04	3.E-05	3.E-05	3.E-06	3.E-04	3.E-05	7.E-04	7.E-05	6.E-05	6.E-06	6.E-04	6.E-05
<b>Pesticides</b>												
4,4'-DDT	4.E-03	4.E-04	NC	NC	NC	NC	4.E-03	4.E-04	NC	NC	NC	NC
Hexachlorobenzene	1.E-02	1.E-03	NC	NC	NC	NC	1.E-02	1.E-03	NC	NC	NC	NC
<b>Metals</b>												
Aluminum	6.E-01	6.E-02	4.E-01	4.E-02	2.E-01	2.E-02	<b>1.E+00</b>	1.E-01	8.E-01	8.E-02	4.E-01	4.E-02
Antimony	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Arsenic	4.E-02	2.E-02	1.E-02	6.E-03	3.E-02	1.E-02	5.E-02	2.E-02	3.E-02	1.E-02	2.E-02	8.E-03
Cadmium	3.E-02	8.E-03	1.E-02	4.E-03	2.E-02	4.E-03	3.E-02	7.E-03	2.E-02	5.E-03	7.E-03	2.E-03
Chromium	<b>1.4.E+01</b>	<b>3.3.E+00</b>	3.E-01	8.E-02	<b>1.E+01</b>	<b>3.E+00</b>	<b>5.E+01</b>	<b>1.3E+01</b>	3.E-01	8.E-02	<b>5.24.E+01</b>	<b>1.29.E+01</b>
Chromium, Hexavalent	8.E-01	8.E-02	NC	NC	NC	NC	<b>2.E+00</b>	2.E-01	NC	NC	NC	NC
Copper	2.E-02	9.E-03	6.E-03	3.E-03	1.E-02	6.E-03	3.E-02	2.E-02	6.E-03	3.E-03	3.E-02	1.E-02
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	2.E-01	1.E-01	7.E-02	4.E-02	1.E-01	7.E-02	2.E-01	1.E-01	9.E-02	5.E-02	1.E-01	8.E-02
Mercury	8.E-02	4.E-02	3.E-02	1.E-02	<b>5.E-02</b>	3.E-02	2.E-01	<b>8.E-02</b>	<b>5.E-03</b>	3.E-03	1.E-01	7.E-02
Silver	8.E-01	8.E-02	NC	NC	NC	NC	<b>9.E+00</b>	9.E-01	NC	NC	NC	NC
Thallium	3.E-02	3.E-03	NC	NC	NC	NC	1.E-01	1.E-02	NC	NC	NC	NC
Tin	<b>2.E+00</b>	9.E-01	2.E-03	7.E-04	<b>2.E+00</b>	9.E-01	<b>2.E+01</b>	<b>8.E+00</b>	3.E-03	1.E-03	<b>1.97.E+01</b>	<b>7.92.E+00</b>
Vanadium	2.E-01	2.E-02	7.E-02	7.E-03	2.E-01	2.E-02	4.E-01	4.E-02	1.E-01	1.E-02	3.E-01	3.E-02
Zinc	2.E-02	2.E-03	1.E-02	2.E-03	6.E-03	7.E-04	3.E-02	3.E-03	2.E-02	2.E-03	8.E-03	9.E-04
<b>Inorganics</b>												
Cyanide, Total	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>EPH</b>												
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

**Notes:**

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC - Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

**Shaded and Bolded values indicate HQs > 1**

**Table 4.5-3**  
**Summary of Food Chain Model Hazard Quotients - Exposure Area 5**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	Red-Tailed Hawk											
	CTE								RME			
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
<b>Volatile Organics</b>												
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>Semivolatile Organics</b>												
Aniline	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzo(a)pyrene	2.E-08	2.E-09	5.E-09	5.E-10	1.E-08	1.E-09	4.E-08	4.E-09	6.E-09	6.E-10	3.E-08	3.E-09
Bis(2-Ethylhexyl)phthalate	2.E-01	2.E-02	1.E-04	1.E-05	2.E-01	2.E-02	6.E-01	6.E-02	2.E-04	2.E-05	6.E-01	6.E-02
Diphenyl ether	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Fluoranthene	1.E-08	1.E-09	7.E-10	7.E-11	1.E-08	1.E-09	7.E-08	7.E-09	1.E-09	1.E-10	7.E-08	7.E-09
N-Nitrosodi-n-propylamine	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Phenanthrene	1.E-09	1.E-10	1.E-10	1.E-11	1.E-09	1.E-10	8.E-10	8.E-11	2.E-10	2.E-11	6.E-10	6.E-11
Pyrene	4.E-09	4.E-10	4.E-10	4.E-11	4.E-09	4.E-10	8.E-09	8.E-10	7.E-10	7.E-11	7.E-09	7.E-10
<b>Pesticides</b>												
4,4'-DDT	2.E-06	2.E-07	NC	NC	NC	NC	2.E-06	2.E-07	NC	NC	NC	NC
Hexachlorobenzene	7.E-07	7.E-08	NC	NC	NC	NC	7.E-07	7.E-08	NC	NC	NC	NC
<b>Metals</b>												
Aluminum	1.E-04	1.E-05	7.E-05	7.E-06	3.E-05	3.E-06	2.E-04	2.E-05	1.E-04	1.E-05	6.E-05	6.E-06
Antimony	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Arsenic	5.E-05	2.E-05	1.E-05	5.E-06	3.E-05	1.E-05	6.E-05	3.E-05	2.E-05	1.E-05	4.E-05	2.E-05
Cadmium	4.E-06	1.E-06	1.E-06	3.E-07	3.E-06	7.E-07	3.E-06	8.E-07	2.E-06	5.E-07	1.E-06	3.E-07
Chromium	2.E-02	4.E-03	1.E-05	4.E-06	2.E-02	4.E-03	6.E-02	2.E-02	2.E-05	6.E-06	6.E-02	2.E-02
Chromium, Hexavalent	3.E-04	3.E-05	NC	NC	NC	NC	2.E-03	2.E-04	NC	NC	NC	NC
Copper	3.E-05	2.E-05	4.E-06	2.E-06	3.E-05	1.E-05	8.E-05	4.E-05	5.E-06	2.E-06	8.E-05	4.E-05
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	2.E-04	1.E-04	4.E-05	2.E-05	1.E-04	8.E-05	2.E-04	1.E-04	6.E-05	4.E-05	2.E-04	9.E-05
Mercury	2.E-06	1.E-06	3.E-07	1.E-07	2.E-06	1.E-06	7.E-06	3.E-06	4.E-07	2.E-07	7.E-06	3.E-06
Silver	4.E-06	4.E-07	NC	NC	NC	NC	4.E-05	4.E-06	NC	NC	NC	NC
Thallium	9.E-06	9.E-07	NC	NC	NC	NC	4.E-05	4.E-06	NC	NC	NC	NC
Tin	2.E-01	8.E-02	2.E-04	6.E-05	2.E-01	8.E-02	<b>2.E+00</b>	7.E-01	2.E-04	9.E-05	<b>1.75.E+00</b>	7.04.E-01
Vanadium	2.E-05	2.E-06	7.E-06	7.E-07	2.E-05	2.E-06	4.E-05	4.E-06	1.E-05	1.E-06	3.E-05	3.E-06
Zinc	4.E-06	4.E-07	2.E-06	2.E-07	2.E-06	2.E-07	7.E-06	8.E-07	4.E-06	5.E-07	3.E-06	3.E-07
<b>Inorganics</b>												
Cyanide, Total	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>EPH</b>												
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

**Notes:**

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

**Shaded and Bolded values indicate HQs > 1**

**Table 4.5-3**  
**Summary of Food Chain Model Hazard Quotients - Exposure Area 5**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	Short-Tailed Shrew											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
<b>Volatile Organics</b>												
Acetaldehyde	5.E-06	5.E-07	NC	NC	NC	NC	8.E-06	8.E-07	NC	NC	NC	NC
<b>Semivolatile Organics</b>												
Aniline	9.E-05	9.E-06	NC	NC	NC	NC	9.E-05	9.E-06	NC	NC	NC	NC
Benzaldehyde	4.E-06	2.E-06	2.E-06	1.E-06	2.E-06	1.E-06	7.E-06	4.E-06	3.E-06	2.E-06	4.E-06	2.E-06
Benzo(a)pyrene	1.E-01	1.E-02	3.E-02	3.E-03	9.E-02	9.E-03	3.E-01	3.E-02	4.E-02	4.E-03	2.E-01	2.E-02
Bis(2-Ethylhexyl)phthalate	<b>6.E+00</b>	6.E-01	4.E-03	4.E-04	<b>6.E+00</b>	6.E-01	<b>2.E+01</b>	<b>2.E+00</b>	6.E-03	6.E-04	<b>2.09.E+01</b>	<b>2.09.E+00</b>
Diphenyl ether	2.E-01	2.E-02	NC	NC	NC	NC	1.E+00	1.E-01	NC	NC	NC	NC
Fluoranthene	3.E-02	1.E-02	2.E-03	8.E-04	3.E-02	1.E-02	2.E-01	8.E-02	3.E-03	1.E-03	2.E-01	8.E-02
N-Nitrosodi-n-propylamine	5.E-03	5.E-04	NC	NC	NC	NC	5.E-03	5.E-04	NC	NC	NC	NC
Phenanthrene	6.E-01	6.E-02	5.E-02	5.E-03	5.E-01	5.E-02	3.E-01	3.E-02	8.E-02	8.E-03	2.E-01	2.E-02
Pyrene	3.E-02	2.E-02	3.E-03	2.E-03	3.E-02	2.E-02	6.E-02	3.E-02	5.E-03	3.E-03	5.E-02	3.E-02
<b>Pesticides</b>												
4,4'-DDT	1.E-01	2.E-02	NC	NC	NC	NC	1.E-01	2.E-02	NC	NC	NC	NC
Hexachlorobenzene	1.E-01	3.E-02	NC	NC	NC	NC	1.E-01	3.E-02	NC	NC	NC	NC
<b>Metals</b>												
Aluminum	<b>2.E+01</b>	<b>2.E+00</b>	<b>2.E+01</b>	<b>2.E+00</b>	<b>7.E+00</b>	7.E-01	<b>4.E+01</b>	<b>4.E+00</b>	<b>3.E+01</b>	<b>3.E+00</b>	<b>1.54.E+01</b>	<b>1.54.E+00</b>
Antimony	2.E-03	1.E-03	NC	NC	NC	NC	2.E-03	1.E-03	NC	NC	NC	NC
Arsenic	<b>2.E+00</b>	2.E-01	7.E-01	7.E-02	1.E+00	1.E-01	<b>2.E+00</b>	2.E-01	<b>1.E+00</b>	1.E-01	8.E-01	8.E-02
Cadmium	3.E-02	7.E-03	1.E-02	3.E-03	2.E-02	4.E-03	2.E-02	6.E-03	2.E-02	5.E-03	6.E-03	2.E-03
Chromium	<b>6.E+00</b>	4.E-01	5.E-01	3.E-02	<b>5.E+00</b>	3.E-01	<b>2.E+01</b>	<b>1.E+00</b>	5.E-01	3.E-02	<b>2.13.E+01</b>	1.26.E+00
Chromium, Hexavalent	7.E-01	7.E-01	NC	NC	NC	NC	1.E-01	1.E-01	NC	NC	NC	NC
Copper	2.E-02	2.E-03	8.E-03	8.E-04	1.E-02	1.E-03	4.E-02	4.E-03	9.E-03	9.E-04	3.E-02	3.E-03
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	2.E-01	6.E-03	8.E-02	2.E-03	1.E-01	4.E-03	2.E-01	7.E-03	1.E-01	3.E-03	1.E-01	4.E-03
Mercury	5.E-02	5.E-03	2.E-02	2.E-03	3.E-02	3.E-03	9.E-02	9.E-03	2.E-03	2.E-04	8.E-02	8.E-03
Silver	3.E-01	2.E-01	NC	NC	NC	NC	<b>4.E+00</b>	<b>2.E+00</b>	NC	NC	NC	NC
Thallium	4.E-01	4.E-02	NC	NC	NC	NC	<b>1.E+00</b>	1.E-01	NC	NC	NC	NC
Tin	<b>2.E+01</b>	<b>1.E+01</b>	1.E-02	9.E-03	<b>2.E+01</b>	<b>1.E+01</b>	<b>2.E+02</b>	<b>1.E+02</b>	2.E-02	1.E-02	<b>1.54.E+02</b>	<b>1.03.E+02</b>
Vanadium	8.E-01	8.E-02	2.E-01	2.E-02	5.E-01	5.E-02	<b>1.E+00</b>	1.E-01	4.E-01	4.E-02	9.E-01	9.E-02
Zinc	4.E-03	1.E-03	3.E-03	8.E-04	1.E-03	3.E-04	5.E-03	1.E-03	4.E-03	1.E-03	1.E-03	3.E-04
<b>Inorganics</b>												
Cyanide, Total	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>EPH</b>												
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

**Notes:**

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

**Shaded and Bolded values indicate HQs > 1**

**Table 4.5-3**  
**Summary of Food Chain Model Hazard Quotients - Exposure Area 5**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	Red Fox											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
<b>Volatile Organics</b>												
Acetaldehyde	2.E-09	2.E-10	NC	NC	NC	NC	3.E-09	3.E-10	NC	NC	NC	NC
<b>Semivolatile Organics</b>												
Aniline	3.E-08	3.E-09	NC	NC	NC	NC	3.E-08	3.E-09	NC	NC	NC	NC
Benzaldehyde	1.E-09	7.E-10	7.E-10	4.E-10	7.E-10	3.E-10	3.E-09	1.E-09	1.E-09	6.E-10	1.E-09	7.E-10
Benzo(a)pyrene	9.E-06	9.E-07	2.E-06	2.E-07	6.E-06	6.E-07	2.E-05	2.E-06	3.E-06	3.E-07	2.E-05	2.E-06
Bis(2-Ethylhexyl)phthalate	5.E-03	5.E-04	3.E-06	3.E-07	5.E-03	5.E-04	2.E-02	2.E-03	5.E-06	5.E-07	2.E-02	2.E-03
Diphenyl ether	2.E-06	2.E-07	NC	NC	NC	NC	1.E-05	1.E-06	NC	NC	NC	NC
Fluoranthene	5.E-07	3.E-07	3.E-08	1.E-08	5.E-07	2.E-07	3.E-06	1.E-06	5.E-08	2.E-08	3.E-06	1.E-06
N-Nitrosodi-n-propylamine	2.E-06	2.E-07	NC	NC	NC	NC	2.E-06	2.E-07	NC	NC	NC	NC
Phenanthrene	7.E-06	7.E-07	6.E-07	6.E-08	6.E-06	6.E-07	4.E-06	4.E-07	1.E-06	1.E-07	3.E-06	3.E-07
Pyrene	4.E-07	3.E-07	4.E-08	3.E-08	4.E-07	2.E-07	9.E-07	5.E-07	8.E-08	5.E-08	8.E-07	5.E-07
<b>Pesticides</b>												
4,4'-DDT	1.E-05	3.E-06	NC	NC	NC	NC	1.E-05	3.E-06	NC	NC	NC	NC
Hexachlorobenzene	4.E-06	9.E-07	NC	NC	NC	NC	4.E-06	9.E-07	NC	NC	NC	NC
<b>Metals</b>												
Aluminum	5.E-03	5.E-04	3.E-03	3.E-04	1.E-03	1.E-04	8.E-03	8.E-04	5.E-03	5.E-04	3.E-03	3.E-04
Antimony	9.E-08	9.E-08	NC	NC	NC	NC	9.E-08	9.E-08	NC	NC	NC	NC
Arsenic	8.E-04	8.E-05	2.E-04	2.E-05	5.E-04	5.E-05	1.E-03	1.E-04	5.E-04	5.E-05	5.E-04	5.E-05
Cadmium	5.E-06	1.E-06	3.E-06	7.E-07	2.E-06	6.E-07	4.E-06	1.E-06	3.E-06	9.E-07	1.E-06	3.E-07
Chromium	2.E-03	1.E-04	2.E-05	9.E-07	2.E-03	1.E-04	7.E-03	4.E-04	2.E-05	1.E-06	7.E-03	4.E-04
Chromium, Hexavalent	1.E-05	3.E-06	NC	NC	NC	NC	7.E-05	2.E-05	NC	NC	NC	NC
Copper	2.E-05	2.E-06	3.E-06	3.E-07	1.E-05	1.E-06	3.E-05	3.E-06	3.E-06	3.E-07	3.E-05	3.E-06
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	5.E-05	2.E-06	2.E-05	5.E-07	3.E-05	1.E-06	6.E-05	2.E-06	2.E-05	7.E-07	4.E-05	1.E-06
Mercury	1.E-06	1.E-07	3.E-07	3.E-08	9.E-07	9.E-08	3.E-06	3.E-07	2.E-07	2.E-08	3.E-06	3.E-07
Silver	5.E-06	3.E-06	NC	NC	NC	NC	6.E-05	3.E-05	NC	NC	NC	NC
Thallium	7.E-05	7.E-06	NC	NC	NC	NC	3.E-04	3.E-05	NC	NC	NC	NC
Tin	3.E-02	2.E-02	2.E-05	1.E-05	3.E-02	2.E-02	2.E-01	2.E-01	3.E-05	2.E-05	2.E-01	2.E-01
Vanadium	1.E-04	1.E-05	4.E-05	4.E-06	9.E-05	9.E-06	2.E-04	2.E-05	7.E-05	7.E-06	2.E-04	2.E-05
Zinc	4.E-07	1.E-07	3.E-07	9.E-08	1.E-07	3.E-08	6.E-07	2.E-07	4.E-07	1.E-07	1.E-07	4.E-08
<b>Inorganics</b>												
Cyanide, Total	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>EPH</b>												
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

**Notes:**

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

**Shaded and Bolded values indicate HQs > 1**

Prepared by: EYM 7/16/2013

Checked by: SFR 7/18/2013

Revised: SFR 2/25/2014

Revised: AMR 11/21/2019

**Table 4.5-4**  
**Summary of Food Chain Model Hazard Quotients - Upper South Ditch**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	Green Heron				Marsh Wren				Raccoon				Muskrat				
	CTE		RME		CTE		RME		CTE		RME		CTE		RME		
	Exposure Area	NOAEL HQ	LOAEL HQ	Exposure Area	NOAEL HQ	LOAEL HQ	Exposure Area	NOAEL HQ	LOAEL HQ	Exposure Area	NOAEL HQ	LOAEL HQ	Exposure Area	NOAEL HQ	LOAEL HQ	Exposure Area	NOAEL HQ
<b>Volatile Organics</b>																	
2,4,4-Trimethyl-1-pentene	NC	NC	NC	NC	NC	NC	NC	NC	1.E-07	1.E-08	2.E-07	2.E-08	2.E-04	2.E-05	3.E-04	3.E-05	
2,4,4-Trimethyl-2-pentene	NC	NC	NC	NC	NC	NC	NC	NC	2.E-08	2.E-09	3.E-08	3.E-09	3.E-05	3.E-06	3.E-05	3.E-06	
4-iso-Propyltoluene	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	9.E-10	9.E-11	9.E-10	9.E-11	3.E-07	3.E-08	3.E-07	3.E-08	
Formaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	2.E-06	2.E-07	3.E-06	3.E-07	6.E-04	6.E-05	9.E-04	9.E-05	
<b>Semivolatile Organics</b>																	
3 & 4 Methylphenol	NC	NC	NC	NC	NC	NC	NC	NC	4.E-09	4.E-10	8.E-09	8.E-10	1.E-06	1.E-07	3.E-06	3.E-07	
Acetophenone	NC	NC	NC	NC	NC	NC	NC	NC	3.E-11	3.E-12	3.E-11	3.E-12	1.E-08	1.E-09	1.E-08	1.E-09	
Azobenzene	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
Benzo(a)pyrene	4.E-10	4.E-11	4.E-10	4.E-11	9.E-09	9.E-10	9.E-09	9.E-10	3.E-09	3.E-10	3.E-09	3.E-10	3.E-06	3.E-07	3.E-06	3.E-07	
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	2.E-09	1.E-09	4.E-09	2.E-09	7.E-07	4.E-07	1.E-06	6.E-07	
Bis(2-Ethylhexyl)phthalate	5.E-01	5.E-02	2.E+00	2.E-01	2.E+01	2.E+00	9.E+01	9.E+00	1.E-05	1.E-06	5.E-05	5.E-06	1.E-02	1.E-03	6.E-02	6.E-03	
Caprolactam	NC	NC	NC	NC	NC	NC	NC	NC	2.E-11	2.E-12	2.E-11	2.E-12	6.E-09	6.E-10	6.E-09	6.E-10	
Diphenyl ether	NC	NC	NC	NC	NC	NC	NC	NC	2.E-07	2.E-08	2.E-07	2.E-08	2.E-04	2.E-05	3.E-04	3.E-05	
Di-n-octylphthalate	2.E-03	2.E-04	2.E-03	2.E-04	6.E-02	6.E-03	6.E-02	6.E-03	7.E-09	2.E-09	7.E-09	2.E-09	8.E-06	2.E-06	8.E-06	2.E-06	
Diphenylmethanone	NC	NC	NC	NC	NC	NC	NC	NC	6.E-09	6.E-10	6.E-09	6.E-10	7.E-06	7.E-07	7.E-06	7.E-07	
N-Nitrosodi-n-propylamine	NC	NC	NC	NC	NC	NC	NC	NC	9.E-10	9.E-11	2.E-09	2.E-10	9.E-07	9.E-08	2.E-06	2.E-07	
Phenol	NC	NC	NC	NC	NC	NC	NC	NC	5.E-09	4.E-09	7.E-09	5.E-09	2.E-06	1.E-06	2.E-06	2.E-06	
<b>Metals</b>																	
Aluminum	1.E-04	1.E-05	4.E-04	4.E-05	2.E-03	2.E-04	9.E-03	9.E-04	5.E-05	5.E-06	2.E-04	2.E-05	5.E-02	5.E-03	2.E-01	2.E-02	
Arsenic	1.E-03	4.E-04	2.E-03	7.E-04	3.E-02	1.E-02	5.E-02	2.E-02	5.E-05	5.E-06	9.E-05	9.E-06	6.E-02	6.E-03	1.E-01	1.E-02	
Barium	1.E-04	5.E-05	3.E-04	1.E-04	4.E-03	2.E-03	1.E-02	5.E-03	4.E-07	2.E-07	1.E-06	5.E-07	4.E-04	2.E-04	1.E-03	5.E-04	
Beryllium	1.E-02	1.E-03	2.E-02	2.E-03	5.E-01	5.E-02	8.E-01	8.E-02	3.E-07	3.E-07	5.E-07	5.E-07	2.E-04	2.E-04	3.E-04	3.E-04	
Chromium	7.E-01	2.E-01	3.E-02	6.E-03	7.E-01	2.E-01	1.E+00	3.E-01	8.E-05	5.E-06	2.E-04	1.E-05	6.E-01	4.E-02	1.E-01	8.E-03	
Chromium, Hexavalent	3.E-03	3.E-04	1.E-02	1.E-03	9.E-02	9.E-03	3.E-01	3.E-02	2.E-07	2.E-07	9.E-07	9.E-07	2.E-04	2.E-04	9.E-04	9.E-04	
Cobalt	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
Copper	1.E-06	6.E-07	2.E-06	1.E-06	3.E-05	1.E-05	5.E-05	2.E-05	1.E-08	1.E-09	2.E-08	2.E-09	1.E-05	1.E-06	2.E-05	2.E-06	
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
Lead	3.E-07	2.E-07	5.E-07	3.E-07	7.E-06	4.E-06	1.E-05	6.E-06	3.E-09	8.E-11	4.E-09	1.E-10	2.E-06	7.E-08	4.E-06	1.E-07	
Manganese	4.E-06	4.E-07	4.E-06	4.E-07	8.E-05	8.E-06	1.E-04	1.E-05	3.E-07	1.E-07	4.E-07	1.E-07	3.E-04	1.E-04	4.E-04	1.E-04	
Silver	2.E-03	2.E-04	5.E-03	5.E-04	5.E-02	5.E-03	1.E-01	1.E-02	4.E-07	2.E-07	1.E-06	5.E-07	5.E-04	2.E-04	1.E-03	6.E-04	
Vanadium	9.E-04	9.E-05	1.E-03	1.E-04	4.E-02	4.E-03	5.E-02	5.E-03	2.E-05	2.E-06	2.E-05	2.E-06	7.E-03	7.E-04	1.E-02	1.E-03	
<b>Inorganics</b>																	
Bromide	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
Nitrite as N	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	

**Table 4.5-4**  
**Summary of Food Chain Model Hazard Quotients - Upper South Ditch**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	Green Heron				Marsh Wren				Raccoon				Muskrat			
	CTE		RME		CTE		RME		CTE		RME		CTE		RME	
	Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area	
<b>Specialty Compounds</b>	NOAEL HQ	LOAEL HQ														
Hydrazine	NC	NC														
Dimethylformamide	NC	NC														
<b>EPH</b>																
C11-C22 Aromatics	NC	NC														
C19-C36 Aliphatics	NC	NC														
C9-C18 Aliphatics	NC	NC														

**Notes:**

CTE - Central Tendency Exposure

NC - Not calculated

COPEC - Chemical of Potential Ecological Concern

NOAEL - No Observed Adverse Effects Level

EPH - Extractable Petroleum Hydrocarbons

RME - Reasonable Maximum Exposure

HQ - Hazard Quotient

**Shaded and Bolded values indicate HQs > 1**

LOAEL - Lowest Observed Adverse Effects Level

Prepared by: EYM 7/16/2013

Checked by: SFR 7/18/2013

Revised: SFR 2/25/2014

**Table 4.5-5**  
**Summary of Food Chain Model Hazard Quotients - Lower South Ditch**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	Green Heron				Marsh Wren				Raccoon				Muskrat				
	CTE		RME		CTE		RME		CTE		RME		CTE		RME		
	Exposure Area	NOAEL HQ	LOAEL HQ	Exposure Area	NOAEL HQ	LOAEL HQ	Exposure Area	NOAEL HQ	LOAEL HQ	Exposure Area	NOAEL HQ	LOAEL HQ	Exposure Area	NOAEL HQ	LOAEL HQ	Exposure Area	NOAEL HQ
<b>Volatile Organics</b>																	
2,4,4-Trimethyl-1-pentene	NC	NC	NC	NC	NC	NC	NC	NC	6.E-08	6.E-09	1.E-07	1.E-08	7.E-05	7.E-06	1.E-04	1.E-05	
2,4,4-Trimethyl-2-pentene	NC	NC	NC	NC	NC	NC	NC	NC	2.E-08	2.E-09	2.E-08	2.E-09	3.E-05	3.E-06	3.E-05	3.E-06	
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	6.E-10	6.E-11	6.E-10	6.E-11	2.E-07	2.E-08	2.E-07	2.E-08	
Acetone	4.E-10	4.E-11	4.E-10	4.E-11	3.E-08	3.E-09	3.E-08	3.E-09	1.E-09	3.E-10	1.E-09	3.E-10	4.E-07	8.E-08	4.E-07	8.E-08	
Formaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	1.E-06	1.E-07	1.E-06	1.E-07	3.E-04	3.E-05	4.E-04	4.E-05	
<b>Semivolatile Organics</b>																	
Aniline	NC	NC	NC	NC	NC	NC	NC	NC	3.E-08	3.E-09	3.E-08	3.E-09	8.E-06	8.E-07	8.E-06	8.E-07	
Azobenzene	NC	NC	NC	NC	NC	NC	NC	NC	--	--	--	--	--	--	--	--	
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	6.E-10	3.E-10	6.E-10	3.E-10	2.E-07	1.E-07	2.E-07	1.E-07	
Benzo(a)pyrene	3.E-10	3.E-11	3.E-10	3.E-11	7.E-09	7.E-10	7.E-09	7.E-10	2.E-09	2.E-10	2.E-09	2.E-10	2.E-06	2.E-07	2.E-06	2.E-07	
Bis(2-Ethylhexyl)phthalate	<b>2.E+00</b>	2.E-01	<b>3.38.E+00</b>	3.38.E-01	<b>5.E+01</b>	<b>5.E+00</b>	<b>9.32.E+01</b>	<b>9.32.E+00</b>	6.E-05	6.E-06	1.E-04	1.E-05	8.E-02	8.E-03	1.E-01	1.E-02	
Di-n-octylphthalate	8.E-04	8.E-05	8.E-04	8.E-05	2.E-02	2.E-03	2.E-02	2.E-03	5.E-09	1.E-09	5.E-09	1.E-09	7.E-06	2.E-06	7.E-06	2.E-06	
Diphenyl ether	NC	NC	NC	NC	NC	NC	NC	NC	2.E-06	2.E-07	2.E-06	2.E-07	2.E-03	2.E-04	3.E-03	3.E-04	
Diphenylamine	NC	NC	NC	NC	NC	NC	NC	NC	8.E-09	7.E-10	1.E-08	1.E-09	1.E-05	1.E-06	1.E-05	1.E-06	
N-Nitrosodi-n-propylamine	NC	NC	NC	NC	NC	NC	NC	NC	7.E-10	7.E-11	1.E-09	1.E-10	7.E-07	7.E-08	1.E-06	1.E-07	
<b>Pesticides</b>																	
4,4'-DDT	2.E-05	2.E-06	4.E-05	4.E-06	3.E-04	3.E-05	8.E-04	8.E-05	1.E-07	3.E-08	3.E-07	7.E-08	2.E-04	4.E-05	4.E-04	9.E-05	
Hexachlorobenzene	2.E-05	2.E-06	4.E-05	4.E-06	9.E-04	9.E-05	2.E-03	2.E-04	1.E-07	2.E-08	2.E-07	5.E-08	1.E-04	3.E-05	3.E-04	6.E-05	
<b>Metals</b>																	
Aluminum	9.E-05	9.E-06	3.E-04	3.E-05	2.E-03	2.E-04	8.E-03	8.E-04	4.E-05	4.E-06	2.E-04	2.E-05	4.E-02	4.E-03	1.E-01	1.E-02	
Barium	4.E-05	2.E-05	6.E-05	3.E-05	1.E-03	7.E-04	2.E-03	1.E-03	2.E-07	7.E-08	2.E-07	1.E-07	2.E-04	7.E-05	2.E-04	1.E-04	
Beryllium	2.E-02	2.E-03	3.E-02	3.E-03	9.E-01	9.E-02	1.E+00	1.E-01	5.E-07	5.E-07	8.E-07	8.E-07	3.E-04	3.E-04	4.E-04	4.E-04	
Cadmium	1.E-03	3.E-04	2.E-03	5.E-04	3.E-02	7.E-03	5.E-02	1.E-02	7.E-07	2.E-07	1.E-06	3.E-07	9.E-04	2.E-04	2.E-03	4.E-04	
Chromium	3.E-02	8.E-03	4.E-02	1.E-02	<b>2.E+00</b>	4.E-01	<b>2.40.E+00</b>	5.89.E-01	3.E-04	2.E-05	3.E-03	2.E-04	2.E-01	1.E-02	3.E-01	2.E-02	
Chromium, Hexavalent	5.E-03	5.E-04	9.E-03	9.E-04	1.E-01	1.E-02	3.E-01	3.E-02	4.E-07	4.E-07	7.E-07	7.E-07	4.E-04	4.E-04	7.E-04	7.E-04	
Cobalt	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
Copper	1.E-06	5.E-07	2.E-06	9.E-07	2.E-05	1.E-05	4.E-05	2.E-05	9.E-09	9.E-10	2.E-08	2.E-09	9.E-06	9.E-07	2.E-05	2.E-06	
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
Lead	3.E-07	1.E-07	4.E-07	2.E-07	6.E-06	3.E-06	9.E-06	5.E-06	2.E-09	6.E-11	3.E-09	9.E-11	2.E-06	6.E-08	3.E-06	9.E-08	
Manganese	3.E-06	3.E-07	4.E-06	4.E-07	7.E-05	7.E-06	8.E-05	8.E-06	3.E-07	8.E-08	3.E-07	1.E-07	2.E-04	8.E-05	3.E-04	9.E-05	
Mercury	6.E-03	3.E-03	1.E-02	5.E-03	2.E-01	8.E-02	3.E-01	1.E-01	2.E-06	2.E-07	3.E-06	3.E-07	2.E-03	2.E-04	4.E-03	4.E-04	
Nickel	9.E-04	6.E-04	1.E-03	9.E-04	2.E-02	2.E-02	3.E-02	2.E-02	1.E-06	6.E-07	2.E-06	8.E-07	1.E-03	7.E-04	2.E-03	1.E-03	
Silver	5.E-03	5.E-04	1.E-02	1.E-03	1.E-01	1.E-02	3.E-01	3.E-02	1.E-06	5.E-07	3.E-06	1.E-06	1.E-03	6.E-04	3.E-03	2.E-03	
Tin	7.E-06	3.E-06	7.E-06	3.E-06	5.E-04	2.E-04	5.E-04	2.E-04	2.E-08	1.E-08	2.E-08	1.E-08	1.E-05	8.E-06	1.E-05	8.E-06	
Vanadium	6.E-04	6.E-05	8.E-04	8.E-05	3.E-02	3.E-03	3.E-02	3.E-03	1.E-05	1.E-06	1.E-05	1.E-06	5.E-03	5.E-04	6.E-03	6.E-04	
<b>Inorganics</b>																	
Bromide	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
Nitrite as N	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	

**Table 4.5-5**  
**Summary of Food Chain Model Hazard Quotients - Lower South Ditch**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	Green Heron				Marsh Wren				Raccoon				Muskrat			
	CTE		RME		CTE		RME		CTE		RME		CTE		RME	
	Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area	
<b>Specialty Compounds</b>	NOAEL HQ	LOAEL HQ														
Hydrazine	NC	NC	NC	NC	NC	NC	NC	NC	5.E-10	3.E-10	7.E-10	4.E-10	4.E-07	2.E-07	5.E-07	3.E-07
<b>EPH</b>																
C11-C22 Aromatics	NC	NC														
C19-C36 Aliphatics	NC	NC														
C9-C18 Aliphatics	NC	NC														

**Notes:**

CTE - Central Tendency Exposure

NC- Not calculated

COPEC - Chemical of Potential Ecological Concern

NOAEL - No Observed Adverse Effects Level

EPH - Extractable Petroleum Hydrocarbons

RME - Reasonable Maximum Exposure

HQ - Hazard Quotient

**Shaded and Bolded values indicate HQs > 1**

LOAEL - Lowest Observed Adverse Effects Level

Prepared by: EYM 7/16/2013

Checked by: SFR 7/18/2013

Revised: SFR 2/25/2014

**Table 4.5-6**  
**Summary of Food Chain Model Hazard Quotients - On-PWD/WDW**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	Green Heron				Marsh Wren				Raccoon				Muskrat			
	CTE		RME		CTE		RME		CTE		RME		CTE		RME	
	Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area	
	NOAEL HQ	LOAEL HQ														
<b>Volatile Organics</b>																
Acetone	2.E-08	2.E-09	2.E-08	2.E-09	5.E-07	5.E-08	5.E-07	5.E-08	7.E-08	1.E-08	7.E-08	1.E-08	8.E-06	2.E-06	8.E-06	2.E-06
<b>Nonionic Organics</b>																
Benzene	NC	NC	NC	NC	NC	NC	NC	NC	2.E-07	2.E-08	7.E-07	7.E-08	2.E-05	2.E-06	8.E-05	8.E-06
<b>Metals</b>																
Barium	1.E-03	6.E-04	2.E-03	1.E-03	1.E-02	6.E-03	3.E-02	1.E-02	5.E-06	2.E-06	1.E-05	4.E-06	2.E-03	7.E-04	3.E-03	1.E-03
Beryllium	1.E-01	1.E-02	3.E-01	3.E-02	1.E+00	1.E-01	<b>3.E+00</b>	3.E-01	3.E-06	3.E-06	6.E-06	6.E-06	4.E-04	4.E-04	1.E-03	1.E-03
Cadmium	2.E-02	6.E-03	3.E-02	9.E-03	2.E-01	4.E-02	3.E-01	7.E-02	1.E-05	4.E-06	2.E-05	6.E-06	6.E-03	2.E-03	1.E-02	3.E-03
Chromium	7.E-01	2.E-01	2.E-01	4.E-02	1.E+00	3.E-01	1.E+00	3.E-01	5.E-04	3.E-05	2.E-04	1.E-05	2.E-01	1.E-02	6.E-02	4.E-03
Lead	9.E-02	5.E-02	1.E-01	7.E-02	7.E-01	4.E-01	1.E+00	6.E-01	2.E-04	5.E-06	3.E-04	8.E-06	7.E-02	2.E-03	1.E-01	3.E-03
Mercury	2.E-01	8.E-02	2.E-01	1.E-01	1.E+00	6.E-01	<b>2.E+00</b>	9.E-01	4.E-05	4.E-06	6.E-05	6.E-06	2.E-02	2.E-03	3.E-02	3.E-03
Vanadium	2.E-02	2.E-03	4.E-02	4.E-03	3.E-01	3.E-02	5.E-01	5.E-02	4.E-04	4.E-05	7.E-04	7.E-05	6.E-02	6.E-03	1.E-01	1.E-02

**Notes:**

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

Shaded and Bolded values indicate HQs > 1

Prepared by: EYM 7/16/2013

Checked by: SFR 7/18/2013

Revised: SFR 2/25/2014

**Table 4.5-7**  
**Summary of Food Chain Model Hazard Quotients - Central Pond**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	Green Heron				Marsh Wren				Raccoon				Muskrat			
	CTE		RME		CTE		RME		CTE		RME		CTE		RME	
	Exposure Area NOAEL HQ LOAEL HQ		Exposure Area NOAEL HQ LOAEL HQ		Exposure Area NOAEL HQ LOAEL HQ		Exposure Area NOAEL HQ LOAEL HQ		Exposure Area NOAEL HQ LOAEL HQ		Exposure Area NOAEL HQ LOAEL HQ		Exposure Area NOAEL HQ LOAEL HQ		Exposure Area NOAEL HQ LOAEL HQ	
<b>Volatile Organics</b>																
2,4,4-Trimethyl-1-pentene	NC	NC	NC	NC	NC	NC	NC	NC	2.E-07	2.E-08	3.E-07	3.E-08	2.E-04	2.E-05	3.E-04	3.E-05
2,4,4-Trimethyl-2-pentene	NC	NC	NC	NC	NC	NC	NC	NC	2.E-07	2.E-08	3.E-07	3.E-08	2.E-04	2.E-05	3.E-04	3.E-05
Acetone	2.E-09	2.E-10	2.E-09	2.E-10	1.E-07	1.E-08	1.E-07	1.E-08	6.E-09	1.E-09	6.E-09	1.E-09	2.E-06	4.E-07	2.E-06	4.E-07
Methyl Tertbutyl Ether	NC	NC														
<b>Semivolatile Organics</b>																
3 & 4 Methylphenol	NC	NC	NC	NC	NC	NC	NC	NC	5.E-08	5.E-09	6.E-08	6.E-09	2.E-05	2.E-06	2.E-05	2.E-06
Acetophenone	NC	NC	NC	NC	NC	NC	NC	NC	3.E-10	3.E-11	3.E-10	3.E-11	8.E-08	8.E-09	1.E-07	1.E-08
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	4.E-08	2.E-08	4.E-08	2.E-08	1.E-05	6.E-06	1.E-05	7.E-06
Phenol	NC	NC	NC	NC	NC	NC	NC	NC	5.E-08	4.E-08	5.E-08	4.E-08	2.E-05	1.E-05	2.E-05	1.E-05
<b>Polyaromatic Hydrocarbons</b>																
Benzo(b)fluoranthene	1.E-03	1.E-04	1.E-03	1.E-04	6.E-02	6.E-03	6.E-02	6.E-03	2.E-06	2.E-07	2.E-06	2.E-07	2.E-03	2.E-04	2.E-03	2.E-04
Fluoranthene	2.E-03	2.E-04	2.E-03	2.E-04	1.E-01	1.E-02	1.E-01	1.E-02	1.E-07	7.E-08	2.E-07	8.E-08	2.E-04	9.E-05	2.E-04	1.E-04
Phenanthrene	2.E-03	2.E-04	2.E-03	2.E-04	9.E-02	9.E-03	9.E-02	9.E-03	3.E-06	3.E-07	3.E-06	3.E-07	4.E-03	4.E-04	4.E-03	4.E-04
Pyrene	2.E-03	2.E-04	2.E-03	2.E-04	9.E-02	9.E-03	1.E-01	1.E-02	2.E-07	1.E-07	2.E-07	1.E-07	2.E-04	1.E-04	2.E-04	1.E-04
<b>Metals</b>																
Aluminum	2.E-05	2.E-06	2.E-05	2.E-06	4.E-04	4.E-05	4.E-04	4.E-05	8.E-06	8.E-07	8.E-06	8.E-07	7.E-03	7.E-04	7.E-03	7.E-04
Barium	7.E-04	3.E-04	7.E-04	3.E-04	2.E-02	1.E-02	2.E-02	1.E-02	3.E-06	1.E-06	3.E-06	1.E-06	3.E-03	1.E-03	3.E-03	1.E-03
Beryllium	9.E-03	9.E-04	9.E-03	9.E-04	4.E-01	4.E-02	4.E-01	4.E-02	2.E-07	2.E-07	2.E-07	2.E-07	1.E-04	1.E-04	1.E-04	1.E-04
Chromium	4.E-02	1.E-02	4.E-02	1.E-02	1.E+00	3.E-01	1.E+00	4.E-01	5.E-05	3.E-06	1.E-04	6.E-06	5.E-02	3.E-03	8.E-02	5.E-03
Chromium, Hexavalent	4.E-04	4.E-05	4.E-04	4.E-05	1.E-02	1.E-03	1.E-02	1.E-03	3.E-08	3.E-08	3.E-08	3.E-08	3.E-05	3.E-05	3.E-05	3.E-05
Lead	2.E-02	1.E-02	2.E-02	1.E-02	6.E-01	3.E-01	6.E-01	3.E-01	4.E-05	1.E-06	4.E-05	1.E-06	4.E-02	1.E-03	5.E-02	1.E-03
Manganese	1.E-04	1.E-05	1.E-04	1.E-05	6.E-03	6.E-04	7.E-03	7.E-04	1.E-05	5.E-06	2.E-05	5.E-06	1.E-02	4.E-03	2.E-02	5.E-03
Silver	1.E-08	1.E-09	1.E-08	1.E-09	3.E-07	3.E-08	3.E-07	3.E-08	3.E-11	1.E-11	3.E-11	1.E-11	3.E-08	1.E-08	3.E-08	1.E-08
Tin	4.E-05	2.E-05	4.E-05	2.E-05	3.E-03	1.E-03	3.E-03	1.E-03	1.E-07	8.E-08	1.E-07	8.E-08	7.E-05	5.E-05	7.E-05	5.E-05
Vanadium	5.E-03	5.E-04	5.E-03	5.E-04	2.E-01	2.E-02	2.E-01	2.E-02	9.E-05	9.E-06	9.E-05	9.E-06	4.E-02	4.E-03	4.E-02	4.E-03
<b>Inorganics</b>																
Bromide	NC	NC														
Chloride	NC	NC														
Nitrite as N	NC	NC														
Nitrogen, as Ammonia	NC	NC														
Sulfate	NC	NC														

**Notes:**  
 CTE - Central Tendency Exposure  
 COPEC - Chemical of Potential Ecological Concern  
 HQ - Hazard Quotient  
 LOAEL - Lowest Observed Adverse Effects Level  
 NC - Not calculated  
 NOAEL - No Observed Adverse Effects Level  
 RME - Reasonable Maximum Exposure  
 Shaded and Bolded values indicate HQs > 1

Prepared by: EYM 7/16/2013

Checked by: SFR 7/18/2013

Revised: SFR 2/25/2014

**Table 4.5-8**  
**Summary of Food Chain Model Hazard Quotients - Storm Water Detention Basin**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	Green Heron				Marsh Wren				Raccoon				Muskrat			
	CTE		RME		CTE		RME		CTE		RME		CTE		RME	
	Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area	
	NOAEL HQ	LOAEL HQ														
<b>Volatile Organics</b>																
2,4,4-Trimethyl-1-pentene	NC	NC	NC	NC	NC	NC	NC	NC	2.E-07	2.E-08	2.E-07	2.E-08	2.E-04	2.E-05	3.E-04	3.E-05
2,4,4-Trimethyl-2-pentene	NC	NC	NC	NC	NC	NC	NC	NC	1.E-07	1.E-08	1.E-07	1.E-08	1.E-04	1.E-05	2.E-04	2.E-05
Acetone	3.E-09	3.E-10	3.E-09	3.E-10	2.E-07	2.E-08	2.E-07	2.E-08	8.E-09	2.E-09	9.E-09	2.E-09	3.E-06	5.E-07	3.E-06	6.E-07
<b>Semivolatile Organics</b>																
3 & 4 Methylphenol	NC	NC	NC	NC	NC	NC	NC	NC	3.E-08	3.E-09	5.E-08	5.E-09	1.E-05	1.E-06	2.E-05	2.E-06
Acetophenone	NC	NC	NC	NC	NC	NC	NC	NC	2.E-10	2.E-11	2.E-10	2.E-11	8.E-08	8.E-09	8.E-08	8.E-09
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	3.E-08	1.E-08	4.E-08	2.E-08	9.E-06	4.E-06	1.E-05	6.E-06
N-Nitrosodiphenylamine	NC	NC	NC	NC	NC	NC	NC	NC	3.E-11	3.E-12	3.E-11	3.E-12	3.E-08	3.E-09	3.E-08	3.E-09
Phenol	NC	NC	NC	NC	NC	NC	NC	NC	5.E-08	4.E-08	6.E-08	4.E-08	2.E-05	1.E-05	2.E-05	1.E-05
<b>Polyaromatic Hydrocarbons</b>																
Benzo(a)pyrene	2.E-03	2.E-04	2.E-03	2.E-04	1.E-01	1.E-02	1.E-01	1.E-02	3.E-06	3.E-07	3.E-06	3.E-07	3.E-03	3.E-04	3.E-03	3.E-04
<b>Metals</b>																
Aluminum	NC	NC														
Arsenic	9.E-03	3.E-03	1.E-02	4.E-03	2.E-01	9.E-02	3.E-01	1.E-01	4.E-04	4.E-05	5.E-04	5.E-05	5.E-01	5.E-02	6.E-01	6.E-02
Barium	9.E-04	4.E-04	9.E-04	5.E-04	3.E-02	2.E-02	3.E-02	2.E-02	4.E-06	2.E-06	4.E-06	2.E-06	4.E-03	2.E-03	4.E-03	2.E-03
Beryllium	1.E-02	1.E-03	1.E-02	1.E-03	5.E-01	5.E-02	6.E-01	6.E-02	3.E-07	3.E-07	3.E-07	3.E-07	2.E-04	2.E-04	2.E-04	2.E-04
Chromium	3.E-01	8.E-02	5.E-02	1.E-02	1.E+00	3.E-01	1.E+00	3.E-01	2.E-04	1.E-05	6.E-05	4.E-06	3.E-01	2.E-02	6.E-02	4.E-03
Vanadium	8.E-03	8.E-04	9.E-03	9.E-04	3.E-01	3.E-02	4.E-01	4.E-02	1.E-04	1.E-05	1.E-04	1.E-05	6.E-02	6.E-03	7.E-02	7.E-03
<b>Inorganics</b>																
Chloride	NC	NC														
Nitrite as N	NC	NC														
Nitrogen, as Ammonia	NC	NC														
Sulfate	NC	NC														

**Notes:**

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

**Shaded and Bolded values indicate HQs > 1**

Prepared by: EYM 7/16/2013

Checked by: SFR 7/18/2013

Revised: SFR 2/25/2014

**Table 4.5-9**  
**Summary of Food Chain Model Hazard Quotients - Off-PWD**  
**Baseline Ecological Risk Assessment OU1 & OU2**  
**Olin Chemical Superfund Site**  
**Wilmington, Massachusetts**

COPEC	Green Heron				Marsh Wren				Raccoon				Muskrat			
	CTE		RME		CTE		RME		CTE		RME		CTE		RME	
	Exposure Area NOAEL HQ LOAEL HQ		Exposure Area NOAEL HQ LOAEL HQ		Exposure Area NOAEL HQ LOAEL HQ		Exposure Area NOAEL HQ LOAEL HQ		Exposure Area NOAEL HQ LOAEL HQ		Exposure Area NOAEL HQ LOAEL HQ		Exposure Area NOAEL HQ LOAEL HQ		Exposure Area NOAEL HQ LOAEL HQ	
<b>Volatile Organics</b>																
2,4,4-Trimethyl-1-pentene	NC	NC	NC	NC	NC	NC	NC	NC	4.E-07	4.E-08	1.E-06	1.E-07	5.E-04	5.E-05	1.E-03	1.E-04
2,4,4-Trimethyl-2-pentene	NC	NC	NC	NC	NC	NC	NC	NC	1.E-07	1.E-08	2.E-07	2.E-08	2.E-04	2.E-05	2.E-04	2.E-05
Carbon disulfide	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Formaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	4.E-06	4.E-07	5.E-06	5.E-07	1.E-03	1.E-04	1.E-03	1.E-04
<b>Semivolatile Organics</b>																
3 & 4 Methylphenol	NC	NC	NC	NC	NC	NC	NC	NC	4.E-10	4.E-11	4.E-10	4.E-11	4.E-07	4.E-08	4.E-07	4.E-08
4-Chlorophenyl phenyl ether	NC	NC	NC	NC	NC	NC	NC	NC	3.E-10	3.E-11	4.E-10	4.E-11	4.E-07	4.E-08	6.E-07	6.E-08
Benzo(a)anthracene	3.E-09	3.E-10	1.E-08	1.E-09	8.E-08	8.E-09	3.E-07	3.E-08	2.E-08	2.E-09	1.E-07	1.E-08	2.E-05	2.E-06	1.E-04	1.E-05
Benzo(a)pyrene	7.E-09	7.E-10	2.E-08	2.E-09	1.E-07	1.E-08	4.E-07	4.E-08	5.E-08	5.E-09	1.E-07	1.E-08	4.E-05	4.E-06	1.E-04	1.E-05
Benzo(b)fluoranthene	1.E-08	1.E-09	3.E-08	3.E-09	3.E-07	3.E-08	7.E-07	7.E-08	8.E-08	8.E-09	2.E-07	2.E-08	8.E-05	8.E-06	2.E-04	2.E-05
Benzo(ghi)perylene	7.E-09	7.E-10	2.E-08	2.E-09	2.E-07	2.E-08	4.E-07	4.E-08	5.E-08	5.E-09	1.E-07	1.E-08	5.E-05	5.E-06	1.E-04	1.E-05
Benzo(k)fluoranthene	4.E-09	4.E-10	2.E-08	2.E-09	1.E-07	1.E-08	4.E-07	4.E-08	3.E-08	3.E-09	1.E-07	1.E-08	3.E-05	3.E-06	1.E-04	1.E-05
Carbazole	NC	NC	NC	NC	NC	NC	NC	NC	1.E-07	1.E-08	1.E-07	1.E-08	1.E-04	1.E-05	2.E-04	2.E-05
Chrysene	9.E-09	9.E-10	2.E-08	2.E-09	2.E-07	2.E-08	5.E-07	5.E-08	6.E-08	6.E-09	1.E-07	1.E-08	6.E-05	6.E-06	1.E-04	1.E-05
Dibenz(a,h)anthracene	3.E-09	3.E-10	9.E-09	9.E-10	6.E-08	6.E-09	2.E-07	2.E-08	2.E-08	2.E-09	6.E-08	6.E-09	2.E-05	2.E-06	6.E-05	6.E-06
Diphenyl ether	NC	NC	NC	NC	NC	NC	NC	NC	9.E-07	9.E-08	2.E-06	2.E-07	1.E-03	1.E-04	3.E-03	3.E-04
Diphenylmethanone	NC	NC	NC	NC	NC	NC	NC	NC	5.E-08	5.E-09	1.E-07	1.E-08	6.E-05	6.E-06	1.E-04	1.E-05
Indeno(1,2,3-cd)pyrene	7.E-09	7.E-10	3.E-08	3.E-09	1.E-07	1.E-08	7.E-07	7.E-08	5.E-08	5.E-09	2.E-07	2.E-08	4.E-05	4.E-06	2.E-04	2.E-05
Phenanthrene	4.E-09	4.E-10	1.E-08	1.E-09	9.E-09	9.E-09	2.E-07	2.E-08	4.E-08	4.E-09	1.E-07	1.E-08	4.E-05	4.E-06	9.E-05	9.E-06
Pyrene	2.E-08	2.E-09	5.E-08	5.E-09	5.E-07	5.E-08	1.E-06	1.E-07	1.E-08	6.E-09	2.E-08	1.E-08	1.E-05	6.E-06	2.E-05	1.E-05
<b>Metals</b>																
Aluminum	5.E-05	5.E-06	8.E-05	8.E-06	1.E-03	1.E-04	2.E-03	2.E-04	2.E-05	2.E-06	3.E-05	3.E-06	2.E-02	2.E-03	3.E-02	3.E-03
Arsenic	5.E-03	2.E-03	7.E-03	3.E-03	1.E-01	5.E-02	2.E-01	8.E-02	3.E-04	3.E-05	4.E-04	4.E-05	3.E-01	3.E-02	4.E-01	4.E-02
Barium	1.E-04	7.E-05	2.E-04	9.E-05	5.E-03	2.E-03	6.E-03	3.E-03	5.E-07	2.E-07	7.E-07	3.E-07	5.E-04	2.E-04	7.E-04	3.E-04
Beryllium	9.E-02	9.E-03	1.E-01	1.E-02	4.E+00	4.E-01	4.42.E+00	4.42.E-01	2.E-06	2.E-06	2.E-06	2.E-06	1.E-03	1.E-03	1.E-03	1.E-03
Chromium	8.E-02	2.E-02	1.E-01	3.E-02	4.E+00	1.E+00	7.13.E+00	1.75.E+00	4.E-03	3.E-04	8.E-03	5.E-04	4.E-01	3.E-03	7.E-01	4.E-02
Copper	4.E-02	2.E-02	7.E-02	3.E-02	1.E+00	6.E-01	1.75.E+00	8.73.E-01	3.E-05	3.E-06	5.E-05	5.E-06	4.E-02	4.E-03	7.E-02	7.E-03
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	4.E-06	2.E-06	6.E-06	4.E-06	9.E-05	5.E-05	1.E-04	8.E-05	3.E-08	9.E-10	5.E-08	1.E-09	3.E-05	9.E-07	5.E-05	1.E-06
Manganese	6.E-06	6.E-07	9.E-06	9.E-07	1.E-04	1.E-05	2.E-04	2.E-05	5.E-07	2.E-07	8.E-07	2.E-07	5.E-04	2.E-04	7.E-04	2.E-04
Silver	2.E-02	2.E-03	3.E-02	3.E-03	4.E-01	4.E-02	7.E-01	7.E-02	3.E-06	2.E-06	6.E-06	3.E-06	4.E-03	2.E-03	7.E-03	4.E-03
Vanadium	3.E-03	3.E-04	4.E-03	4.E-04	1.E-01	1.E-02	2.E-01	2.E-02	5.E-05	5.E-06	6.E-05	6.E-06	2.E-02	2.E-03	3.E-02	3.E-03
Zinc	2.E-05	2.E-06	4.E-05	5.E-06	4.E-04	4.E-05	1.E-03	1.E-04	3.E-08	8.E-09	7.E-08	2.E-08	3.E-05	7.E-06	6.E-05	2.E-05
<b>Inorganics</b>																
Bromide	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrite as N	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
<b>Specialty Compounds</b>																
Hydrazine	NC	NC	NC	NC	NC	NC	NC	NC	4.E-10	2.E-10	4.E-10	2.E-10	1.E-07	6.E-08	1.E-07	6.E-08

Notes:

CTE - Central Tendency Exposure

NC - Not calculated

COPEC - Chemical of Potential Ecological Concern

NOAEL - No Observed Adverse Effects Level

HQ - Hazard Quotient